JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES.

Artificial Light as an Aid to Civilization.

THE "Pall Mall Gazette" for the 4th inst. contained an interesting article on "The Dinner Hour," showing how the time at which the principal meal of civilized mankind is taken has been put on by degrees until it is actually nearly twelve hours later than was customary at about the dawn of English literature. It was prefaced by a quotation of Charles Lamb's dictum that "civilization came in with the "candle." It appears by ancient domestic chronicles that in the fifteenth century people took their principal meal at what strikes us now as the outrageous hour of nine o'clock in the morning, supped at four or five in the afternoon, and went to bed about eight or nine at the latest. The division of the day for the purposes of work or pleasure followed suit. Everybody rose at six. The House of Commons met at nine; and its business was over soon after noon. Even when, in the period of the Protectorate, the dinner hour was advanced to one, all organized work or social functions had to be over before nightfall. The curfew at 8 p.m. was no infliction on generations who rose at dawn, and were ready for bed when the shades of evening fell. It was not before the Nineteenth Century was well advanced that the fashionable dining hour was definitely put on to the evening. The writer in the newspaper, however, with all this interesting matter before him, and the profound observation of Charles Lamb for his guidance, did not draw the conclusion which appears so obvious—that the great separation of modern from ancient ways of spending the time allotted to the span of human life is attributable to the introduction of systematized artificial lighting. It is this, and nothing else, that has so profoundly changed the use of the hours of waking life. Only with all respect to the immortal Elia, if civilization came in, as he says it did, with the candle, it did not get far before the candle was superseded for most purposes by gas.

It was gaslight that permitted of the putting off of indoor amusements from the daytime until after dark. Evolutionary teachings allow for the existence, in the midst of change and development, of certain simple forms of life which show no alteration from the time of their first recorded appearance upon the earth. They do not change, simply because they correspond so perfectly with their environment, and answer their own purpose so well, that there is no inducement for them to change. In the same way, the new condition of civilized existence introduced by good artificial lighting affected in the greatest degree the already most highly developed and multifarious classes of society. It did not so much influence the handicraftsman and the outdoor labourer, who still work mostly between the hours of 6 a.m. and 6 p.m. Daylight is as much as it ever was the necessary condition for the greater part of the hand work of the world. But the special sign of the brainworker —the lamp – has been improved out of all likeness to its prototypes, and the advance of learning and the growth of civilization have followed. Tom Moore's notable discovery that "the best of all ways to lengthen our days is to steal "a few hours from the night," has been literally put into practice. Public entertainments, and almost the whole of adult instruction, have been taken from the daylight hours, and are carried on during hours redeemed from darkness. Instead of all work and play ceasing at nightfall, as was formerly the case, with few exceptions, every twenty-four hours now present the world with six or more additional hours for waking employment. The effect of this extension of time upon the fortunes of humanity is incalculable. The telegraph, and the railway, and the steamboat are, in their degree, potent agencies for facilitating the working out by man of his earthly destinies; but they are not to be compared for generative force with that inestimable gain of the Nineteenth Century—organized artificial lighting. It is a thought worth pondering over occasionally, when men are talking about the causes of the differences between ancient and modern kinds of civilization. The civilizations that were before the age of gas lighting, however different from one another in spirit and removed in time, were less unlike than any of them was to that which has been fostered, and developed, and expedited by the circumstance of there being so much more light in the world.

Rejection of the Paris Gas Bill.

BY a rather curious coincidence, the Legislatures of the two countries north and south of the English Channel were occupied last week with the subject of the supply of gas and water in their respective capital cities. In London it was the latter commodity which was in question; in Paris, the former. In both places these important departments of industry have been the subjects of much investigation; and though on this side beneficial results to the consumers have followed, the same cannot be said of the other, at all events, so far as the supply of gas is concerned—and this is all we have to do with here. In Paris, the gas question has been before the public more or less for the past twenty years; but, Commissions notwithstanding, no means have been adopted for relieving the consumers of the heavy burden of a price of 6s. 9d. per 1000 cubic feet. Early in the present year, however, there were signs, as our readers will remember, of a reduction being made to the extent of one-third of this amount; and the scheme by which it was to be brought about, the outlines of which were given in our columns at the time, received the approval of the Municipal Council and also of the Gas Company. Things looked bright, for a few weeks later, when the matter came before the Legislature, in the form of a Bill to legalize the scheme, a worthy deputy was assured by M. Waldeck-Rousseau that the Administration had a strong desire not to neglect anything which would give satisfaction to the people, but that they could not do anything until the Budget was out of the way. By the time this obstacle was removed, the Dissolution was at hand; and on Easter Sunday all Paris was informed, through the usual channels of information—in more or less conspicuous characters—that the Chamber had refused to take up the gas question. This attitude was the result of the adverse criticism of the reporter on the Bill, who declared that by it the interests of the citizens, which it was the duty of the Chamber to protect, were placed in jeopardy. He suggested that the matter should go to the Council of State; and the result was that, after a protracted sitting, the members separated, and left the troublesome subject to be dealt with by the new Parliament.

The Bill was in due course referred to a Committee of the new Chamber, who do not appear to have regarded the matter as being urgent. But, as time was going on, one of the deputies, M. Georges Berry, thought it advisable just to drop a gentle hint to this effect. A few weeks ago he reminded his colleagues that if the agreement come to between M. Chamon and the Municipality were not approved of by the Chamber before the end of the year, it would lapse by effluxion of time; and he followed up his reminder with a motion to the effect that the Committee should be asked to present their report with as little delay as possible. M. de Pressensé, the Chairman of the Committee, pointed out that they had not simply to approve or reject the Chamon scheme, but also to bring forward some proposition. He explained that the Committee had endeavoured to ascertain whether any other arrangement than the one submitted to them would be possible; and in this matter they had had the assistance of the Prefect of the Seine. Now, this official, as was manifest when the question was before the Municipal Council, has always been antagonistic to the scheme, which was passed by only a very narrow majority; and the result of his interview with the Committee was that they came to the conclusion that the question of the reduction of the price of gas need not necessarily be associated with the taking over of the Gas Company's property or with the financial *régime* of their successors. However, the Committee's report would, he added, be presented shortly; and, on this understanding, M. Berry withdrew his motion.

The wished-for document, which had been drawn up by

M. Adrien Veber, a Socialist deputy for Paris, was duly presented to the Chamber, and came under discussion last Tuesday. The Committee, as might have been supposed from the Chairman's answer, recommended the rejection of the Chamon scheme, and the reference of the whole question back to the Municipal Council for further investigation. In support of their conclusion, M. Veber declared that the Council had not sufficiently reflected upon the disastrous financial consequences which the adoption of the scheme would entail upon the city; and he expressed the opinion that, by free competition, it would be possible to formulate some project which would not only spare the Municipal Exchequer, but give consumers gas at 20c., or even less, per cubic metre. The next day the deputies were addressed by M. Spronck, who, it may be remembered, reported upon the Chamon scheme. He warmly defended this solution of the problem, and asked the Chamber to adopt it, not only on account of its numerous advantages, but because it had received the approval of the City Engineers as well as of M. Waldeck-Rousseau. He warned his colleagues that, if they rejected it, the Municipal Council would take it up again; and it would not be they, but the Legislature, who would have to bear the responsibility of retarding the reduction of the price of gas. M. Spronck was followed by M. Louis Puech, a Radical deputy for Paris, who condemned the proposed scheme as unacceptable. As it was carried in the Council by a Nationalist majority, the debate in the Chamber partook of the character of a triangular duel between the members of that party, the Socialists, and the Republicans, though the latter were divided; and the outcome was the rejection of the Bill by 334 votes to 197. The result was welcomed by the Left with a double round of applause.

Thus ended abortively the labour of a year in making one more effort to settle the Paris Gas Question. Whether there will be another, or whether the Company's concession will be allowed to run to its close three years hence, remains to be seen. According to a statement made towards the close of the debate, there is yet another project in the air. The Prefect of the Seine some months ago almost hinted that he had something "pigeon-holed" which he would produce at the right time; and it appears that a new scheme, emanating from the Prefecture, will shortly be submitted to the Chamber, by which, it is said, a reduction in the price of gas will be secured without imposing the onerous financial conditions of the scheme just rejected. Of course, no indication was given as to the nature of the proposal; and it is not worth while to indulge in speculation upon it.

Light at the Manchester Institution Meeting.

MUTUAL illumination is the fundamental object of the combination of men interested in the same professional pursuits; and in their technical proceedings on Saturday, the members of the Manchester Institution of Gas Engineers fulfilled that object without stint. They discoursed on light, and nothing but light; and proof was given that interest in the subject is yet far from the point of exhaustion. It was dealt with in three papers, and in them the members' minds were carried from the question of the measurement of illumination in the home and the street (as distinct from the old theme of the maximum amount of light obtainable from a given consumption of gas) to the lighting of a town by incandescent gas mantles and to various comparisons in the lighting of factories by means of electricity and the incandescent gas system. The authors of the papers were Mr. Henry Fowler, of Derby, Mr. J. H. Brearley, of Longwood, and Mr. J. H. Buckley, of Formby; and in all three cases the contributors to last Saturday's proceedings richly deserved the warm thanks of the members for the amount of definite and instructive information which they succeeded in squeezing into the limits of their communications.

From the scientific standpoint, the paper by Mr. Fowler, on "Working with an Illumination Photometer," ranks first in order; the other two contributions being valuable more for the assistance they will give on the managerial side of the professional gas man's work. "Candle power" and "illumination" are often regarded by many as synonymous terms; but those who look upon them as such have only to consider the high candle power of the electric arc lamp and the illumination it affords under certain conditions to obtain an excellent illustration of the distinction between the terms, and of the mistake they themselves have hitherto laboured under. It is now many years since Mr. Thomas Newbigging drew attention to the difference between candle power and lighting effect; but from that time to this, the subject of illumination apart from that of candle power has not received any general or pronounced systematic study. The little interest that is taken in the subject is remarkably shown by the statement of Mr. Fowler that the makers of the most recent form of illumination photometer (which he believes to be the only practical one that has been put on the market) have decided to abandon its manufacture—at all events, for the present—owing, be it marked, to the worthless demand there is for this class of apparatus. We are decidedly in accord with Mr. Fowler in saying that the study is one which merits greater attention; and it is to be hoped that his paper will do something towards arousing more enthusiasm in the question, and bringing about, as one result, the revocation of the decision of the manufacturers referred to. The form of illumination photometer favoured by Mr. Fowler is that in which the amyl-acetate lamp is used; and his description of it and the experiments he has made will be found highly interesting. It is to be regretted, however, that the curves given by him are, with one exception, the result of experiment in small interiors. In our opinion, the one diagram showing comparative curves taken in an illumination test of a flat-flame street-lamp and of an incandescent gas-lamp is far more interesting. The eye itself is really a sufficient test of the quality of illumination in any given position in, and circumstances of, an apartment of but limited size; and it is in the illumination of large interiors, streets, and open spaces, and for comparisons of the diffusive power of various forms of light that the photometer as described by Mr. Fowler will be found most valuable. If he would (and his opportunities are great) supplement this paper by one giving results and curves obtained under larger and more varied conditions, and with various forms of lamps, the members of the Institution and the gas profession generally would be even more indebted to him than they are to-day.

For freshness of subject, the paper read by Mr. Brearley, on "The Lighting of Factories," claims attention next. It dealt, in an exceptionally thorough manner, with a form of lighting that will appeal more to gas men of the Northern and Midland Counties than to the majority of gas men in the South—in fact, it presents an illustration of the contrapositions of the gas managers North and South in respect of one of the forms of competition they have to meet. It goes without saying that the lighting, by the incandescent gas system, of places packed with moving machinery—such as the factories instanced by Mr. Brearley—is an altogether different matter from the application of incandescent lighting to churches, chapels, and halls, which is the largest kind of installation that many gas managers in the South (exceptions outside London being scattered) have to deal with. Therefore, the paper will be accepted as one of eminent value to all concerned in the lighting of factories and works in the textile and other industrial districts. It is unnecessary for us to extract from the paper the lessons it teaches. They are many, and are so plain that they cannot be missed.

The last matter, however, mentioned by Mr. Brearley is one that should receive the further attention of the Northern Associations. We fail to see that it would be presumptuous on the part of Mr. Brearley or anybody else to try to teach the Insurance Companies their business in any particular line when it is obvious (as in this case) that they are ignoring experience and handicapping an industry by extorting a higher premium from factories using incandescent gas-lights than from factories employing other forms of illumination. It would be interesting if the Insurance Offices would show a "perfectly logical reason" for this. We venture to think they would have some trouble in unearthing one. There has now been sufficient experience in the lighting of factories by incandescent burners to confute any fear they may have formerly had, and to prove to them which of the two systems of lighting—incandescent gas or electricity—is the more prolific of conflagration. Certainly we cannot call to mind the case of a single factory that has suffered through the adoption of the former system; while we are equally certain the insurance people would have no difficulty in citing instances regarding claims produced by the rival system. This is really an important matter to gas undertakings in all the Northern Counties—not so much for the amount of extra premium imposed by the Insurance Offices, as of the seemingly true voucher of safety qualification

that it gives to electricity in comparison with incandescent gas lighting; and it is a point of which no electrician, alert for new business, would be so simple as not to make the most. For this reason alone, it would be, in our view, a wise step for the Manchester, the North of England, and the Midland Associations to jointly take up this question, by means of a Special Committee, in order to press the matter on the attention of the Insurance Offices, with a view of getting, if possible, the two forms of illumination placed on an equality in regard to premium.

The experiences of Mr. Buckley, as related in the third paper, on "Incandescent Street Lighting at Formby," is also a serviceable production in several respects. It discloses, above all things, that he appreciates what has been urged in these columns many times, and that is the value of good street lighting as an advertising medium, even if the income and expenditure of this branch leave at the end no surplusage of the former. It is not very complimentary to the intelligence of the inhabitants of Formby to learn that it was not until 1898 that lighting became general in their streets; but it is gratifying to know that it was by the aid of the Gas Company that the ratepayers redeemed their character in this respect. A further lesson of the paper is the absurdity of the policy of placing public incandescent gas lighting in the hands of a contractor other than the suppliers of the gas. As to the high average of Mr. Buckley's account for maintenance, we have no doubt that, having already done so much in the matter of giving light to the (a few years ago) benighted inhabitants of Formby, he will succeed in time in reducing that average.

The Gas Referees' New Notification—The Testing of 14-Candle Gas.

THE Notification of the London Gas Referees for the year 1903 has been issued; and, as usual, those into whose hands the paper may come are left to find out for themselves wherein the new orders differ from the old. This official reticence at least makes it incumbent upon everyone whose duty it is to know these instructions to go carefully over the new paper and compare it with the old. We have done this with the new Notification, and have discovered a significant novelty. It is that the gas supplied by the Gaslight and Coke Company, which is of 16-candle power, and that supplied by the South Metropolitan Company, which is of 14-candle power, form a class by themselves; and the gas supplied by the Commercial Company, which is likewise 14-candle gas, is distinguished by special treatment. A fresh table for the purpose appears in Appendix E, for the reason that Commercial gas is to be burnt to give a standard light of 14 candles, not a 16-candle flame, as in the case of the other two Companies. The alteration of the table photometer required to obtain the equality of light on the photoped at the two testing-places for the gas of the Commercial Company is marked on the printed plan of the instrument. Whereas the 16-candle flame is 522 millimetres from the standard pentane lamp and 1265 millimetres from the photoped, for testing the Commercial Company's gas the distances are to be reduced to 473 millimetres and to 1183 millimetres respectively. Gauge-rods for making these different measurements are specified. The test burner is, of course, the same; but three different sizes of chimney are requisite—possibly four. The 16-candle gas of the Gaslight and Coke Company is to be burnt with a $1\frac{7}{8}$-inch chimney; that of the South Metropolitan Company with a $1\frac{3}{4}$-inch chimney, or a 2-inch chimney if the flame mounts above the top; and the Commercial gas is to have a $1\frac{5}{8}$-inch chimney. There is nothing like standardization and having a system in these matters! This, it is understood, is what the Referees are for. They do not deign to say a word about the use of one and the same burner to give flames of 16 or 14 candle light, nor to explain why they have adopted a special mode of testing the gas of the Commercial Company. Their Notification rehearses their duty as comprising the prescription and certifying of the apparatus in the testing-stations, and the mode to be adopted for testing and recording the illuminating power, &c., of the gas to be provided by the Companies. Thus they can have as many different arrangements as there are testing-stations, if they like; but the standard burner is beyond their power to alter structurally. They make up for this uniformity of construction by diversifying the use, which must be the scientific thing to do, or the Referees would not do it. All the same, as Parliament charged both the 14-candle Companies the same for allowing them to drop the two candles in illuminating power, it would seem to less scientific persons that the fact of the reduction should, in fairness, be ascertained and measured in one and the same way.

Incandescent Mantle Litigation in Austria.

ELSEWHERE in this issue, we publish a translation of a report of the opening proceedings in a legal case in which Dr. Auer von Welsbach is concerned, and which bears upon the discovery which, as the "JOURNAL" records at the time show, he made in 1891 in connection with the fluid for the preparation of incandescent mantles. Propriety forbids comment upon the case at this stage; but it is interesting at the present time to look back and read what was said in 1891 and 1892 about that invention, for it now seems to be shrouded in a little mystery. In the "JOURNAL" register of applications for letters patent in 1891, there appears the following: "15,286.—The Incandescent Gas-"Light Company, Limited, 'An Improved Manufacture of "Incandescence Bodies.' A communication from C. Auer "von Welsbach. Sept. 9." But pursuing investigations, we failed to find in our columns the usual abstract of the specification; and, on application at the Patent Office, the information is given that the patent was "abandoned." The discovery was referred to in a circular which Mr. Julius Moeller sent out to gas companies later in the year; and, again, in December, 1902 (more than a year later), the then Chairman of the Incandescent Gas-Light Company—Admiral Sir Edward Inglefield—was speaking of it in laudatory terms. There is no doubt about an improvement having been made in the mantles at that date; for Sir Edward told the shareholders that, in view of the good results obtained from the "lamps" supplied, the sales for the three previous months had been from four to five times as great as in the corresponding period of the preceding year. Under such circumstances, it seems strange that the patent was "abandoned." However, perhaps the case now proceeding in Vienna will give our readers some light on the matter. In the incandescent trade, there seems to be considerable interest to learn what the case as it proceeds may divulge.

The Taff Vale Case.

THE most important lawsuit ever entered into in connection with Trade Unionism—viz., the action in the King's Bench Division, before Mr. Justice Wills and a Special Jury, of the Taff Vale Railway Company against the Amalgamated Society of Railway Servants—is now in progress; and the result will be looked for with the keenest interest by all employers of labour and "organized" workpeople. The great strike on the Taff Vale Railway system of August, 1900, now seems almost a matter of ancient history; so that it is expedient to recapitulate the leading facts. The most important of all was that there was at the time a Trade Union claiming the allegiance of railway men, of which Richard Bell, James Holmes, and others now joined with the Society as defendants, were the moving spirits. The Society published a paper called the "Railway Review," which was the means of carrying on the propaganda of the Union; and in this paper, in September, 1899, overtures in the interest of Unionism were directly addressed to the Taff Vale men. The men were upbraided for their indifference to this interest; and efforts were made to get them into another frame of mind. During this critical period, when the Society did not seem to make much headway with the Taff Vale hands, something happened which was made use of as the electric spark to fire the mine which the Society had prepared against the Company. This was the alleged "putting upon" of a signalman named Ewington, who was also the District Secretary of the Union, and who, it was asserted, was victimized on account of his having figured on a deputation to the Board.

It was not the first time this Railway Company had had experience of the Union's tactics. There was a strike on the line in 1890, when these new Societies were in their heyday, and various notorious people, not employers of labour themselves, were carried away by the plausible pretences of those who were engineering these new combinations of Socialism and Trade Unionism, and failed to see in them any danger to the various industries they affected. That strike was managed and controlled by the Society; and it

resulted in an agreement as to employment, signed by the Chairman of the Company and the Secretary of the Society. As might be supposed, this settlement proved to be no settlement at all. The men had a Committee of their own for bringing grievances before the Directors; and, of course, these subjects were never lacking. The constant meddling of the Committee became intolerable; and the order went out that the men must bring their own cases forward, as they had always been at liberty to do. It was the virtual contentment of the men with this state of things that disgusted the officials of the Union, and caused their renewed interference with the Taff Vale in 1900, for which the case of Ewington was made a handle.

The members of the Society thereupon began to send in their fortnight's notices to leave work on Aug. 6, on which date 363 such notices were received; on Aug. 13, another batch of 400 notices came in; and on Aug. 19, a meeting of the Executive of the Society was held in London, at which it was resolved to support the men, and Bell took charge of the movement. The strike began at midnight of that day by 1229 of the men turning out; and the usual incidents duly occurred. Picketing was ordered; "blacklegs" were warned off or sent away; and before the strike ended, which was on Aug 31, the Company were put to an expense of about £24,000, which they are now seeking to recover out of the funds of the Society. The defence is a denial of the alleged unlawful acts and damage, and an assertion that if such acts were done by Bell, Holmes, or other persons, they were unauthorized by the Society.

Damages for Injury to a Gas-Main at Sandown.

An interesting case, in which the Sandown Gas Company sued the Isle of Wight Electric Light and Power Company for the value of gas lost through the acts and negligence of servants of the latter Company, is reported in our "Legal "Intelligence" columns to-day. It was alleged that one of the Electric Light Company's men, in the course of laying their cable, drove a pickaxe into the gas-main; thus starting a leak which was not reported to the Gas Company, but left to be discovered after six months by the injury done to shrubs in the vicinity. The Electric Light Company were willing to pay for the damaged pipe, but repudiated liability for the escaped gas. The Manager of the Gas Company (Mr. H. W. Falkner), however, acted with commendable prudence in the matter, and had the delivering capacity of the fracture tested independently by Mr. H. J. Ibbotson, the Engineer and Manager of the Newport Gas Company, and this gave him a very strong case. It was contended for the defence that, inasmuch as the Gas Company had received the statutory notice of the proposed work, it was their own business to exercise proper superintendence, and see that no damaged gas-pipe was covered in. Their failure to do this was pleaded as constituting contributory negligence. This was the novel contention in the case; and the Court wanted to be informed what precedents (if any) exist for setting up such a plea, but none was cited. His Honour gave judgment for the Gas Company; being chiefly moved thereto, as he said, by the fact that the Electric Light Company admitted their liability for the damage done to the main. This being so, the liability to pay for the lost gas followed; and, in view of the entirely circumstantial nature of the proof as to the quantity of gas in question, the Judge thought that £15 would about meet the justice of the case. The defendants asked for leave to appeal, in order that the legal point raised might be decided; and the Judge acceded to the request, conditionally on the nature of the point being satisfactorily expressed. At the same time, his Honour observed that he thought the law of the matter perfectly clear. The giving of a statutory notice, or the possession of statutory powers to do the work, does not absolve the parties from responsibility for their proper and harmless performance. It would be a dangerous rule to make, that the right of inspection given to a Gas Company in such circumstances carries with it all the responsibility for everything that may be improperly done or omitted to be done.

Sir Edward Clarke on Municipal Enterprise.

Municipal trading, and Municipalism and Socialism generally, were much discussed once more during the past week. There seems to be a strong body of public opinion favouring the view that this is really the one thing worth talking about at the present time in connection with local government. And although some people ask, with Sir Edward Clarke, for the appointment of a Royal Commission to investigate the subject in England, there are others who think it preferable that the matter should be kept before the public eye for a little time longer, before it is comfortably put to bed in the way we have just indicated. By a remarkable coincidence, the very same newspapers which last week reported Sir Edward Clarke's desire for a Royal Commission to inquire into municipal trading, also reported a dictum of a leading member of the Government who, being twitted in the House of Commons with not having cast the London Water Bill on the lines recommended by the Royal Commission, placidly remarked that the advice of Royal Commissions was hardly ever taken. But we do not believe that Sir Edward Clarke really needs enlightenment upon this subject (on which he spoke at last week's meeting of the London Municipal Society), at the hands of a Royal Commission or even of a Parliamentary Committee. He knows exactly where to find the weak spot in popular Municipalism, which is the book-keeping. He laid it down that all municipalities should come under the obligation that the accounts of every undertaking of theirs should be kept separate and distinct, so that the truth about them might be known by the ratepayers. He also argued in favour of never allowing so-called trading profits to be used in relief of rates. With such a bait, he said, ratepayers would vote in favour of almost any municipal adventure in the kingdom. If, on the other hand, it was clearly understood that the profits of every such venture should be applied to the improvement of the service itself, this would be a valuable check upon extravagance in all municipal proposals of the kind. Sir Edward Clarke has the courage of his opinions, and he is willing to admit that the great example of national trading for a profit—the Post Office—would be much better if it did not contribute a single shilling to the National Exchequer. The Society, after a speech from Lord Claud Hamilton, in which he dilated upon the enormous increase in the rates—as much as 369 per cent. in West Ham during the past ten years, in the case of the Great Eastern Railway—passed a resolution in favour of asking the Government to appoint a Royal Commission to inquire into the scope of municipal enterprise.

The Capping of Gas Service-Pipes.

With regard to the recent fatal gas poisoning case at Heywood, to which we referred in a paragraph under this heading in last week's "Journal," it seems that there are several points which, had they been properly explained at the inquest, would have made a good deal clearer the position of the Corporation in the matter. In the first place, all the meters (except those used for stoves, &c.) in Heywood are owned either by the landlords or the consumers; and therefore, in the case under consideration, the Corporation were compelled to leave the meter upon the premises. Then, under ordinary conditions, the inspector who gave evidence simply examines the meters in use; and it is the duty of another official to inspect those places where supplies have been permanently discontinued. The circumstances in the case referred to were, however, exceptional, this being the only instance in the district where gas was supplied for cooking purposes and not for lighting—the latter having been discontinued through leakage in the fittings. This explains how it was that the lighting meter came to be overlooked. But the somewhat peculiar conditions existing at Heywood with regard to the ownership of meters, would seem to make it more than usually desirable that some means should be devised to prevent the surreptitious recoupling up by consumers of unconnected supplies. The way of doing this which most readily suggests itself is that recommended by the Jury, of affixing a seal to the cap with which disconnected pipes are plugged; and though, of course, this is an arrangement not usually made, there seems to be no adequate reason why the effect of it should not be tried.

Interference of Local Authorities.

In the "Journal" for last Tuesday and to-day we have been able to report two cases of interference by local authorities with the main-laying operations of companies. In the first instance

it was a gas company who gave rise to this action, and in the second it was a water company. More is likely to be heard of both cases; and the results will be awaited with interest. When, however, these troubles occur, the remedy is usually in the hands of the companies themselves. Let them but obtain statutory powers, and they are then in a position to snap their fingers at the local authorities who try to make things unpleasant for them. So long as they do not do this, they are, of course, more or less at the mercy of the whims of councillors, who after allowing things to go on pleasantly for ever so many years may suddenly develop a wish to make them as uncomfortable as possible for the company. Even though these tactics may be unsuccessful, it is far better to avoid the friction which always arises over the discussion of matters of this kind by rendering such discussion outside the range of practical politics. And it is only by securing statutory powers that this end can be satisfactorily achieved.

With Gas Companies.

The Barnard Castle Gas Company is a case in point. This Company laid their mains in 1834; and until 1900 no question was raised in regard to them. After, however, a trifling lapse of about 66 years, the Urban District Council suddenly arrived at the conclusion that the Company ought either to obtain statutory authority to open the roads or else pay a yearly wayleave for their mains. The Company, in spite of this resolution having been passed by the Council, continued to pursue the even tenour of their way, with the result that, as reported last week, they finally found themselves in the Police Court under section 149 of the Public Health Act of 1875, which vests the streets in the Council. For the Company, it was contended that, as their pipes had been in the ground for so many years, they had gained by prescription a right to lay them. Upon this point the Magistrates did not give a decision, but adjourned the case for a fortnight to see if the parties could come to terms. Before the hearing is resumed the Company and Council may have arrived at an agreement, and so have ended the dispute. Our object, however, in calling attention to the matter here is to repeat once more what we have so often said before, and that is that gas and water companies will find the cost of obtaining a Special Act or Provisional Order is money well spent, as by this means they secure rights and privileges which can be challenged by no one.

And Water Companies.

The case of the Rickmansworth Water Company (which is referred to in our "Miscellaneous News" to-day) is altogether different. Here the Local Authority have, whether or not right is on their side, apparently acted in a most high-handed manner, and one for which we can only hope that they may ultimately be made to pay smartly. The Company recently laid—it is said without giving notice, and in a district within which they have no jurisdiction—about 70 yards of water-mains; and this proceeding so alarmed the Surveyor to the Eton Rural District Council (the Local Authority concerned) that he next day borrowed from one of the members a traction engine with which he deliberately dragged the pipes out of the ground. This action was endorsed by the Council at their last meeting; so that they will now have to stand by the Surveyor in what he has done "in the exercise of his duty." Some discussion took place as to whether they should indict the Company for having committed a criminal offence, apply for an injunction, or make a claim for damages; and the latter was decided upon—presumably as being the course which was most likely to benefit the Council's exchequer. These extraordinary proceedings are, of course, merely the outcome of a long dispute between the Company and the authorities; and one of the members of the Council said he understood the work of laying the main was done by "a gang of men sent from Rickmansworth, who came in the middle of the night. They probably thought they would be able to get done without anyone knowing about it." Seeing that the Chairman of the Rickmansworth Water Company is Sir Henry E. Knight, it is difficult to believe that they have not a satisfactory explanation of their conduct to offer; but whether they have or not, the Eton District Council could surely have found some means of getting the question settled less likely to cause ill-feeling than the step taken by the Surveyor on their behalf.

The Maidstone Explosion.

It is stated that litigation is possible between the Maidstone Corporation and the Gas Company, in order to settle who is legally responsible for the damage caused by the recent fatal explosion on the bridge over the Medway. At the present stage, therefore, it would be improper to make any remarks upon the matter. Indeed, very little has transpired, beyond a bare narration by one or two eye-witnesses of what took place. It was intimated at the inquiry that a large number of witnesses could be called; but the Coroner (being no doubt of opinion that the circumstances would be fully gone into elsewhere) said he should refuse to take any expert evidence or to hear any controversial statements. The Board of Trade, also, intimated that they did not see their way to take any steps in the matter. However the explosion may have occurred, it is evident that the unfortunate man who lost his life was in no way to blame. There has of late been an unusually heavy crop of fatalities caused by gas; but most of them have been the direct result of carelessness, and so could, and should, have been prevented. That in this instance the deceased was in no degree responsible for his own destruction, must tend to increase the regret one feels for the occurrence.

A New Retort-House for Birmingham.

The Birmingham Gas Committee have been permitted to change their mind; and there have been two things which have caused them to wish to do so. In 1898, a scheme was formulated for extensions and reconstructions at the Windsor Street and Adderley Street works; but now they desire to abandon this, and instead to erect further works at Nechells. Since the first scheme was prepared, the Committee have secured land of which they had at that time no hope; and besides this Mr. Charles Hunt has retired, and the whole undertaking has been placed under one Engineer (Mr. Henry Hack). Circumstances thus having changed, one would have thought that the proposal of the Committee to alter their plans would have met with universal approval; and so it did—very nearly. Mr. Walthall, however, moved an amendment; and, after a short interval, he succeeded in finding a seconder. But the latter gentleman explained that he only rose to say something on another matter—which was promptly ruled out of order. Mr. Walthall appeared to be imbued with the pleasant idea that the Committee could supply gas or not just as they chose; and he thought that, instead of further extending the gas undertaking, they ought to turn their attention to the development of the electricity works. As if it were at all a matter of choice, and the Committee could hold a loaded pistol to the heads of the ratepayers and say: "Give up gas and take to electricity at once!" The Committee cannot limit their gas undertaking, even if they would, for they are under statutory obligation to supply gas, not only to the city, but also to the surrounding neighbourhood. These obligations they are anxious to fulfil; and no obstacle should be placed in their way by members of the Council. The maximum daily demand is rapidly approaching the existing manufacturing capacity; and further provision is therefore absolutely essential. The altered scheme agreed to by the Council last week includes a new retort-house of 5 million cubic feet capacity per diem, with purifying and other plant, at Nechells, at an estimated cost of £165,000. Beyond this, a further sum of £35,000 is required for fitting up prepayment meter supplies, making the total amount needed £200,000. As an offset, the authority they already possessed to borrow £202,000 for works at Windsor Street and Adderley Street has been rescinded. In face of the progress which is being made by the Birmingham Gas Department, it is perhaps not to be wondered at that the supporters of electricity are becoming a little uneasy.

Councillor Helps and Others Warned.

One of the representatives of the West Ward of Croydon is an irrepressible who bears the name of Stranks; another is Mr. J. W. Helps, who is not unknown to readers of the "JOURNAL" as Engineer and General Manager of the Croydon Gas Company, which Company have certain business relations with the Council. Of course, there may be no connection between the facts here stated; but it is rather curious that, immediately after Mr. Helps had taken his seat as a town councillor, Mr. Stranks (who, we believe, is a verbose member of the labour party) should have seen fit to call attention to the question of councillors being

directors and officials of companies contracting with the Corporation, and to quote an opinion on the subject of Mr. Cunningham Glen, Q.C. The letter in which Mr. Stranks brought the matter under notice has been considered by the Finance Committee; and they have informed the Council that they can do no more than repeat a former report on the subject. Under section 12 of the Municipal Corporations Act, 1882, a member of a council is not disqualified by reason of his having any share or interest in (*inter alia*) any company under the Companies' Act, 1862, who contract with the council. Sub-section 3 of section 22 of the former Act also provides that a member of a council shall not vote or take part in any discussion on any matter before the council or a committee in which he has directly or indirectly by himself or his partner any pecuniary interest. Under these circumstances, the Committee strongly recommended that no member of the Council who is a shareholder in a company or a director should, either in Committee or in Council, take part in any discussion or vote on any question arising between such company and the Council, whether it be in respect of the acceptance of a tender or any question arising under a contract between such company and the Corporation, or otherwise affecting the interests of such company. Alderman Foss dealt very briefly with Mr. Stranks, in moving the adoption of the report. Disqualification, as the Alderman says, has really nothing to do with the Council. If a member is disqualified, the law points out an effectual means of dealing with him; so that every member sits on the Council at his own risk. However, Mr. Stranks is not satisfied; and, though he denies that spite or anything of the kind has moved him, he hints that the matter may be heard of again in the Council. In the meanwhile, if our surmise is true, that the councillor has his eye on Mr. Helps, he will find that gentleman a wary bird, and not likely to be trapped.

Financial Chaos in Hackney.

The ratepayers of Hackney are up in arms over the financial affairs of the Borough Council, which have been revealed by the Local Government Auditor's report to be in a chaotic condition. So great is the excitement over the matter, that one of the largest meetings of ratepayers ever held in the Town Hall has demanded a full investigation; and this the Council have felt compelled to accede to, and, to their credit be it said, they have done so unanimously. The total inaccuracies, according to the Auditor, represent a deficiency of £40,000; and among the items appear interest on loan for the Electric Lighting Committee, from March, 1899, to March 31, 1901, amounting to £2801, charged to capital funds. The ratepayers' meeting disclosed a new use for the much lauded dust-destructor. Three of the rate collectors have been discharged, without due inquiry, in connection with some of the financial discrepancies; and the incensed ratepayers were informed at the meeting by the Secretary of the Ratepayers' Association that, if witnesses were protected, he would be able to prove that certain books which would make the case of one of the collectors quite clear had been burned in the dust-destructor. In the midst of this financial chaos, the ratepayers are not likely to find much solace in the announcement made at the Council meeting, on the eleven months' working of the electric lighting undertaking to Sept. 29, that there was a deficit of only £73. The progress is described as "unprecedented and phenomenal;" but, before accepting this, it would be instructive to have a few more details, in order to ascertain whether interest and other charges have been taken into the calculation. However, on the larger matter, the Whitehall authorities are not likely, in view of their own Auditor's report, to disregard the ratepayers' demand for an investigation.

Legal Absurdities.

The letting out of heavy machinery on the hire-purchase system has received a severe blow by a decision of the Court of Appeal reported recently. According to the "Financial Times," the lessee of a piece of land was in 1892 building a factory on it, and in that year he mortgaged the premises together with the fixtures thereon. This mortgage subsequently became vested in the defendants. After the execution of the mortgage, the plaintiff let a quantity of heavy machinery to the lessee of the factory on the hire-purchase system. The machinery was to continue the absolute property of the plaintiff until the last payment of hire was made; and he was to be at liberty, in certain events, to put an end to the hiring, and repossess himself of the machinery. Each machine was on a concrete bed; and upright iron bolts were fixed in the concrete, and the machines secured in place by nuts—power being conveyed by means of a band. The plaintiff ultimately, under the terms of the agreement, put an end to the hiring, and demanded the return of the machinery. Unfortunately for him, however, the mortgagees had a few days before taken possession of the premises; and they declined to give up the machinery, which they contended had been so fixed as to become part of the land, and so had passed under the mortgage. Hence the action, in which it was decided that, as a presumption of law, machines so arranged must be regarded as fixtures, and therefore covered by the mortgage. Plaintiff could have removed the machines before the defendants took possession of the place; but as it was, he was too late. This is one of the cases in which it is such a very great pity that it appears to be impossible to get behind the letter to the spirit of the law; and we agree with our contemporary that "it seems highly unjust that a mortgagee should thus be able to acquire a windfall at the expense of a third person—especially where, as in the present case, the machinery was not on the premises at the time of the mortgage."

Gas-Stove Inspectresses.

According to the "Daily Telegraph," feminine enterprise flows into unexpected channels in the United States. It appears from the statement of a correspondent that in Riverside, California, the Gas Company have appointed a lady, whose duty it will be to call on consumers at intervals in order to instruct them in the capabilities of gas in cookery. She will also act as an inspectress of stoves, &c. Further, she is to hold a daily "At Home," in order to meet anyone and everyone interested in the use of gas, and to give advice on recipes and the preparation of food. The gratuitous instruction in gas cookery has already been offered to the British housewife; but how far she would welcome a periodical visitation to her house by the lady employee of the Gas Company, to give advice and inspect her kitchen arrangements, is hard to say. There is no doubt that a good deal of carelessness and incompetence exist in connection with the use of gas-stoves; but we are inclined to think, with the writer in the "Telegraph," that the institution of the lady inspector in this country would be resented, or, at all events, would not be a success.

Successful Technical Instruction at Newport (Mon.).

It is scarcely necessary to lay stress, in such a publication as the "JOURNAL," upon the advisability of appointing, as the head of a commercial or an industrial undertaking, or even of a department of one of these, a man who has had special training in the business, or possesses unusual mental capacity which enables him to quickly master details. As such men as the latter are rare, it becomes necessary to prepare for these positions any who may prove capable, with proper study, of filling them; and hence the value of technical schools. These institutions, however, may fail to achieve their object unless they have at their head men who are in entire sympathy with the work carried on. It was doubtless with a thorough consciousness of this fact that the members of the Technical Instruction Committee of the County Borough of Newport (Mon.), seven years ago selected as their Chairman Mr. Thomas Canning, the Engineer and Manager of the Newport Gas Company; and we venture to assert that to this judicious step is due, in large measure, the success which has attended the Technical Institute of the borough, as evidenced at the annual distribution of prizes by Lord Tredegar last Wednesday. On that occasion, the Head Master of the Art Department (Mr. W. Bush) stated that the number of students in the past year was 549; while in the Science Department, at the head of which is Mr. J. J. Stewart, the number was 462, compared with 428 and 280 in the two immediately preceding sessions. As the result of the internal examinations, 168 certificates were gained by 144 students. Mr. Stewart, in the course of his report, made the gratifying statement that the students in engineering seemed to be "more anxious to gain a knowledge of the scientific principles underlying their daily work" than appeared to be the case with those who had taken up some other branches of technology. This is the spirit—this desire to know the "why and the wherefore"—which should

be encouraged. There is far too great a tendency with some teachers to burden the memory of the student, instead of training his reasoning faculties. This does not appear to be the course pursued at Newport. As an example of what the Technical Institute there can do, a case was cited by Mr. Stewart of a student who entered quite ignorant of chemistry, and in two years gained so good a knowledge of the subject, especially in its application to brewing, that he was awarded a medal by the City and Guilds of London Institute, and was placed at the head of the examination list for the whole of the United Kingdom.

Its Cost and Effect.

"But at what cost to the ratepayers is this work carried on?" is a question which may well be put. Mr. Canning shall answer it. He told Lord Tredegar and the assembly on Wednesday last that very little more than 50 per cent. of the annual income of the Institute came out of the rates. The total for the past year was £2705, of which £1412 was provided by the borough fund in the shape of a rate of 1d. in the pound—certainly, not an overburdening amount. The expenditure was £2500, whereof £1600 represented salaries; and the total included the interest and sinking fund on a loan of £4300 in respect of the site of the new buildings, which are greatly needed. As there is a balance in hand of £1011, the Institute is not in the serious financial position which some local croakers are trying to make out. But even if the figures were less favourable than they are, surely the expenditure is being incurred in a good cause. Lord Tredegar suggested to his audience that the money spent on the erection of new technical schools would prove more valuable to Newport than some of the outlay incurred on the electric tramways in the town. And why? We will go once more to Mr. Canning for the answer to the question. He said, in the course of his remarks, that "technical schools were calculated to promote the general well-being of a community, because they tended to enhance its prosperity; and prosperity was the best guardian of public institutions. He therefore regarded them as contributing towards that citizenship of which so much was heard nowadays." We congratulate him and his Committee on the success of the good work in which they are engaged, and cordially wish them a continuance of it.

WATER AFFAIRS.

The London Water Bill under Amendment.

THE rumours as to the possibility of a compromise being effected between the Government and the Opposition in regard to the London Water Bill, which, as mentioned in the "JOURNAL" last Tuesday, were current during the preceding week, were quite dispelled when it became known that the consideration of the measure was to be resumed on Thursday, and pushed on with the view of its passing the remaining stages before the prorogation. Accordingly, all the necessary steps were taken to secure a good attendance of the supporters of the Government; and as, apart from the Metropolitan members, the occupants of the Opposition benches did not display any keen interest in the Bill, little doubt was entertained that it would be disposed of well in advance of Christmas. The aspect of the House when the discussion in Committee—adjourned on the 18th of July—was re-opened, fully justified the confidence of the Government of their eventual success in solving a problem which many have thought to be impossible of solution except by placing the water supply of the Metropolis in the hands of the London County Council. The President of the Local Government Board has found another way; and although his scheme is far from being what those who will be chiefly affected by it hoped and believed it would be, there is good ground for his claim that it is the only practical proposal likely to be accepted by Parliament. Moreover, it has the approval and support of nearly the whole of the Metropolitan Boroughs. In any scheme for dealing with the supply of water in London, these new bodies, as well as those representing the outside areas, had to be reckoned with; and as they have now attained positions of sufficient importance to justify them in declining to come under the domination of the authority ruling at Spring Gardens, the creation of a controlling Board, on which all the districts comprised in the area of supply would be adequately represented, was the most practicable method of meeting the case. In fact, as everybody knows who has given very much attention to the London Water Question during the past few years, the formation of a Board—not, it must be admitted, on the lines of the one proposed by Mr. Long—was recommended by the last Royal Commission which inquired into the matter.

Given the necessity for a Water Board, how was it to be constituted? This was the problem which confronted the framers of the Bill; and it proved the *crux* of the inquiry before the Joint Committee early in the session. It was also the question upon which discussion was concentrated on Thursday. Mr. Long had brought from the third schedule to the Bill his scheme for a Board of 73 members, and he proposed its incorporation in clause 1, in order that a vote might be taken upon it before the rest of the Bill was discussed. It met, as before, with hostile criticism, mainly on the ground that the Board would be unwieldy and unworkable. The views of the Opposition were embodied in an amendment submitted by Sir John Dickson-Poynder, the effect of which was to reduce the membership of the Board to 33, of whom 14 would have been nominated by the London County Council, instead of the 10 allowed by the Government. He was, however, unsuccessful in getting it carried. Nevertheless Mr. Long consented to deprive five of the Metropolitan Boroughs of one member each. This concession probably led to an attempt being made by Captain Norton to have the City of London similarly treated. But the honourable and gallant member spoke in the presence of the late Lord Mayor, who reminded him of what the City had done during the past twenty years to bring the Water Question to a focus—not merely for the benefit of their "one "square mile," but of the whole Metropolis. The House did not go to the trouble of dividing upon this amendment, but at once negatived it. These were the noteworthy features of Thursday's discussion.

The next day, Mr. Lough endeavoured to deprive Walthamstow of its representative, and have that district grouped with the other urban districts of Essex; but Mr. Long declined to entertain the proposal. He nevertheless expressed his willingness to vary the proportions of representation between Inner and Outer London, if, by the grouping of areas, it could be done; and he asked that this concession should be reciprocated by the settlement, for the time being, of the scheme then before the House. Sir Henry Campbell-Bannerman promptly acknowledged that the suggested rearrangement would meet a good many of the objections of his friends. By Mr. Long's conciliatory attitude, the chief difficulty in regard to the first clause of the Bill was removed. But the clause was not quite done with. Mr. Rae objected to the portion providing for the payment of the Chairman and Vice-Chairman by the Board; and Mr. Long agreed to make a verbal alteration which would leave the payment optional. He also promised to introduce words giving the right of appointing these officials to the Water Board instead of to the Local Government Board. On the motion that clause 1 should stand part of the Bill, there was renewed discussion on its principle—viz., that it proposed to set up a Water Board when, in fact, none was wanted. However, the motion was carried, after some discussion, by 124 to 40—a majority of 84. Thereupon the Committee proceeded to deal with clause 2, providing for the transfer of the undertakings of the Water Companies to the Board. Mr. Lough tried to restore the word "consideration," which the Joint Committee had altered to "compensation," in respect of the payment to be made; but he failed. He next endeavoured to obtain the omission of the words sanctioning the making of agreements between the Board and the Companies. In this he was again unsuccessful; but he managed to extract from Mr. Long a promise to again consider this matter before the report stage. The clause, as amended, was added to the Bill, as were the next two; and progress was reported.

The concessions made by the Government in the constitution of the new Board have cut away much of the ground from under the feet of the Opposition. There was a very thin House on Friday; and a feeling prevailed that there was not much left worth fighting for. According to one of the "Political Notes" in "The Times" last Saturday, it was quite expected that the Committee stage of the Bill would terminate last night, so as to allow of the measure being promptly reported and read the third time. Of course,

the London County Council are not satisfied with the Bill; and at their meeting to-day they will be asked by the Parliamentary Committee to express the opinion that the passing of the measure in its present form would be detrimental to the interests of London.

Water-Works Engineers and the Interests of Ratepayers and Consumers.

For the seventh time, the members of the British Association of Water-Works Engineers have held a winter meeting; and the interest in these interim gatherings does not sag in the least. It is true that the invitation to the December meetings which the Secretary (Mr. Percy Griffith) issues is not so largely responded to as in the case of the annual convention in the more genial month of July. One can hardly expect that it would be, as a single day's meeting may not, in many instances, justify the expenditure of money and time incurred where a long railway journey is necessary. Nevertheless, the number who do attend the winter assemblies, and the quality of the technical work done at them, fully compensate for their convocation. The meeting at Burlington House last Saturday was not, as an example, anything exceptional. For three hours and a half the members present applied themselves seriously to the business on the *agenda;* and the papers and discussions, when published, will be found worthy of the closest attention on the part of all concerned in water-works matters.

It is really a noticeable feature of the meetings of professional gas and water men lately, how largely the interests of the consumers bulk in their proceedings, to the exclusion to that extent of purely technical matters. Just as the Manchester District Institution of Gas Engineers were commencing the consideration of two gas subjects in which ratepayers and gas consumers are intimately concerned, the Water-Works Engineers had very shortly before finished the discussion of a similar number of papers on water-supply matters, in which the pockets of the ratepayers and the consumers' enjoyment of a proper service of suitable water for domestic and trade purposes were in question. It is not intended to discuss the papers to-day; but, in proof of what has just been stated, the subjects may be mentioned. In the first paper, by Mr. W. H. Humphreys, of York, "The "Coating of Water-Pipes" was the topic. Without going beyond the title, this appears to be an essentially technical matter. But badly coated pipes produce unpalatable water; and that is where the consumer comes in. The second paper was by Mr. T. Molyneux; and it dealt with the "Water-"Softening Plant at the Wilmslow Station of the Stockport "Corporation Water-Works." The author's reply to the discussion revealed the fact that the softening is a requirement in connection with the district's manufacturing demands. Well, then, who can be more interested than the consumers in Mr. John Shaw's paper, which formed the third, on "The Detection and Prevention of Underground "Pollution"? We will give more consideration to the papers when publishing them.

There was little business beyond that already referred to. The membership was still further increased; and the officers for the ensuing year were elected. Mr. Frederick Griffith (who has had an excellent year in office) is to be followed in the presidency by Mr. R. H. Swindlehurst, M.Inst.C.E., of Bolton. This gentleman is one of the original members of the Association; and he has hitherto been more of a worker in the administration than a talker at the meetings. The succession to the presidency is well provided for by the selection as Vice-Presidents of Mr. F. J. Bancroft, of Hull, and Mr. E. A. B. Woodward, of Wolverhampton. For their next annual meeting, the members received a hearty invitation from the Chairman and members of the Bolton Corporation Water-Works Committee to visit that town.

The County Council and the London Water Bill.—Referring to the report of the Parliamentary Committee of the London County Council, to which allusion is made in the concluding sentence of the first article on "Water Affairs," the "Pall Mall Gazette" yesterday said: "The London County Council has solemnly washed its hands of the Water Bill. This act of disavowal of the Parliamentary Committee is not surprising, since the Council is a competitor with the proposed Water Board for the control of Greater London's water supply. But the fact will place the disavowal in its true light. The L.C.C. is not a competent juror in the controversy, and we must look to the more impartial judgment of Parliament for a judicial verdict."

ESSAYS AND REVIEWS.

REFORM OF PRIVATE BILL PROCEDURE.

The Select Committee of the House of Commons appointed to inquire into the Standing Orders applying to private business have reported; and the report, with the recommendations of the Committee, has been issued as a Parliamentary Paper. The Committee was a strong one. They sat on nine days, and took evidence from several members and officials of the House of Commons, from officials of the House of Lords, and from professional and other representative witnesses experienced in the business of Private Bill Legislation. We had occasion to notice some of this evidence at the time. The report gives a brief statement of the provisions of the existing Standing Orders, which constitutes a useful account of our parliamentary procedure in regard to Private Bills. As it is a long time since such a statement appeared in the "Journal," and the subject is of greater interest than ever it was, we give the Committee's account in condensed form.

Notices of Private Bills must be published in the "London Gazette" and local newspapers during October and November; but not later than Nov. 27. Notices to owners, lessees, and occupiers must be served before Dec. 15. Plans are to be deposited by Nov. 30; and in some cases notices are required by Dec. 31, and money deposits have to be made by Jan. 15. All Private Bills must be deposited in the House of Commons by Dec. 21 in each year, and printed copies deposited on the same date at the Treasury and other public departments; and provision is made by which the reports of the departments are considered and reported on by the Committees of the House to which the Bills are referred. On Jan. 18, the Examiners of Petitions for Private Bills commence their sittings under regulations made by the Speaker, and certify, by endorsement on each petition, whether the Standing Orders have or have not been complied with. No Private Bill can be brought into the House save on a petition first presented, which shall have been duly deposited in the Private Bill Office and endorsed by one of the Examiners. These petitions must be presented to the House not later than three clear days after endorsement, if the House is sitting.

At the commencement of each session, the Chairman of Ways and Means and the Chairman of Committees of the House of Lords confer as to which House shall first receive the Bills. All Private Bills, after being ordered to be brought in, are laid on the table of the House for first reading. All petitions against Private Bills must be presented not later than ten clear days after the first reading; or, in the case of Provisional Orders Confirmation Bills, seven days after notice has been given of the day on which the Bill will be considered by the Examiner. Private Bills promoted by statutory companies go to the Examiner again after first reading, for proof of assent of the proprietors in special meeting. Bills must be read a second time not less than three, nor more than seven, clear days after the first reading, unless where a Bill has been referred to the Examiner of Petitions for Private Bills, in which case it must be read a second time, not later than seven clear days after the report of the Examiner or of the Select Committee on Standing Orders. After second reading, Bills stand referred to the Committee of Selection or the General Committee on Railway and Canal Bills, who group them for Committees. In practice, however, this grouping is done as soon as opposing petitions are deposited and the Committee of Selection and General Committee already named appointed. Provision is made for the appointment of a Committee on Unopposed Bills, which consists of the Chairman of Ways and Means, with one of the backers of the Bill, and another member not locally or otherwise interested, or a Referee. There is a Court of Referees, at present composed of the Chairman of Ways and Means, five independent Members of the House, the Speaker's Counsel, and a Referee. This Court decides as to the rights of petitioners to be heard. Private Bills may be debated in the House on second reading, on instruction to Committees after second reading, on consideration of reports of Committees, and on third reading. The table of fees charged to parties was settled so long ago as 1864.

The first question that arose for the Committee on this procedure was that of time. It takes from 35 to 40 days after the House assembles before the first Private Bill Committee can get to work, which vexatious delay and loss of precious time is partly due to various Standing Orders. Most of the evidence taken by the Committee was on this subject. After running over the testimony and suggestions of the witnesses, the Committee recommend that the date for depositing Bills in the House of Commons should be Dec. 17, which is the same date as required by the House of Lords, instead of Dec. 21 as at present. There was complete unanimity of testimony on this point. The petition for leave to introduce a Bill in the House of Commons is found to be an unnecessary formality, and the Committee recommend its discontinuance. It is not required by the House of Lords. It is further recommended that the Chairman of Ways and Means and the Chairman of Committees in the House of Lords, or their Counsel, should determine before the end of January in

each year to which House the Bills should go first. It is suggested that the first reading stage in the House is a formality which could be dispensed with, and the first reading deemed to occur with the examination for compliance with the Standing Orders. The Examiners should begin to sit on Jan. 12, or a week earlier than at present; the dates of memorials and deposits of money being correspondingly advanced. It is recommended that all petitions against Private Bills should be deposited on or before Feb. 12 in each year. The attention of the Committee was called to the great delay caused in connection with Wharncliffe meetings; and it is proposed that a fixed period of not exceeding five weeks should be allowed between the two references of company Bills to the Examiners.

On the subject of the cost of these proceedings, some interesting recommendations are made. It is suggested that a Joint Committee of the two Houses should be appointed with a view to the revision of the scale of fees and making them the same for each House. Attention was drawn to the great expense of the Parliamentary Notices now required; and the Committee favour something more summary—thinking the form of notice required by the Light Railway Commissioners, would answer every purpose. An important suggestion made was for amalgamating the Private Bill Offices of the two Houses into one, and making one deposit do for all purposes. The Committee consider that as soon as opposing petitions are deposited, the grouping and order in which the groups of Bills should be taken could be determined. The reports of the Local Government Board should be made more promptly. It is thought that if the general public health legislation of England and Wales were brought up to date, many of the Bills now promoted by local authorities would not be wanted; so that both work and expense would be saved in this regard. It is recommended that the Court of Referees should be strengthened, and given wider powers to grant *locus standi* to petitioners whose cases are not covered by existing Standing Orders, and also to award costs. Generally speaking, the Committee think that the Standing Orders as to *locus* are too narrow. They would allow *locus* to associations or bodies sufficiently representing interests or traffic affected by Bills, and also permit a hearing to owners of property the access to which is materially dependent on streets or roads proposed to be used for the construction of a tramway. This is a large extension.

The Committee decline to offer any report on the subject of Joint Committees of the two Houses, or the extension and alteration of the Provisional Order system, as they think these matters should be considered by a Joint Committee. A highly-important recommendation deals with the question of lack of uniformity in the decisions of Committees on Opposed Bills, which is asserted to be largely due to the absence of a proper system of records and means for guiding Chairmen on decided points of principle. At present, every Committee acts as an independent unit; and the resulting confusion would be much more confounded than it is, were it not for the careful study given to all measures by the Lord Chairman of Committees of the Upper House. There does not appear to be any special arrangement for this part of the work of the Lord Chairman; but it is the only check at present on novel and doubtful proposals. One of the most important of the many matters dealt with by the Committee is the procedure in regard to Unopposed Bills. They find that the composition of the Committees on Opposed Bills gives general satisfaction—which is true, now that the House does not sit to such late hours as formerly; but more strength is desirable for securing due consideration of those measures which, because it does not happen to be to the interest of any individual to oppose them, go forward as Unopposed Bills. They may contain proposals of the largest and farthest-reaching kind; and it is not considered fair to expect the Chairman of Committees to master every one of the multifarious projects of this class of Bills, even with the help of the Speaker's Counsel, who stood revealed by the inquiry as a sort of *avocatus diaboli*. The Committee therefore recommend that the Deputy-Chairman should be a salaried official of the House, with responsibility in the absence of the Chairman for all Private Bill business outside the work of the Committees on Opposed Bills. He would be assisted by a panel of four members nominated by the Committee of Selection; and to this tribunal all points of Unopposed Bills affecting the public interest or creating new precedents would be mentioned by the Speaker's Counsel. It is suggested that such a Committee might also be empowered to decide minor points in dispute between parties to Opposed Bills which cannot be settled by agreement, but which are not worth taking before an Opposed Bill Committee.

Cases occur from time to time of parties being put to expense unnecessarily, as by the withdrawal of petitions or Bills at the last moment and without due notice, when all the costs for the hearing have been incurred. It is suggested that the Standing Orders and, if necessary, the Costs Act should be amended so as to cover these cases. It is also proposed to permit the amendment of petitions on certain conditions. At present, it is possible to take exception to some lines of evidence on the ground that they are not covered by the petition, which means either an imperfect hearing or else a second opposition in the other House. Finally, there are two matters relating to procedure before Committee on Opposed Private Bills to which the Committee draw attention. They recommend that where petitioners do not call evidence, Counsel for the promoters should be allowed to sum up his evidence before Counsel for the petitioners is heard, as is the practice in Courts of Law. Also, that whereas, when two or more Bills are heard together, Counsel for the promoters of others than the first Bill is only allowed to address the Committee once—either before or after the calling of his witnesses as he may elect—on several recent occasions, Counsel has been allowed, by special leave, to make a short statement, mainly in explanation of his own case, before calling his witnesses, and to address the Committee again at a later stage in support of his whole case and against that of the other Bill or Bills. This new practice has been found to the advantage of both Committee and the parties; and its general adoption is recommended.

MORAL RESPONSIBILITIES OF EMPLOYERS.

THE sensational circumstances attending the death, and the German Emperor's speech at the funeral, of Herr Friedrich Krupp—who, there is only too good reason to believe, died a victim to the malicious slanders of the Socialists who hated him because his employees were too well paid and cared for—have served to call attention to the policy pursued by Herr Friedrich, and his famous father, Alfred Krupp, before him, for the establishment and maintenance of amicable relations between them and their great host of employees. The Krupps—father and son—were firm believers in the policy of attaching their employees to them by looking after their welfare—bodily, mental, and moral—in every possible way. The care taken of, and the interest shown in, their employees and their employees' wives and children can, in fact, be best described as paternal. The fact that this policy has been extremely successful does not, of course, prove that it would be attended by equally happy results in a country where more independence of spirit prevails, and workmen often prefer to be uncomfortable in their own way rather than comfortable in somebody else's. But, combined with a policy of giving the employees a share in the profits, and of bringing them into partnership as shareholders, the plan of taking the initiative in founding institutions for the recreation, physical improvement, and mental and moral uplifting of those dependent upon them, is one that can be pursued by large employers of labour with great advantage to themselves as well as to those they strive to benefit, and might be more generally adopted than it is at present in our own country. The "welfare-institutions" established at the Krupp works at or near Essen (where some 43,000 hands are employed, and upon which about 150,000 souls are dependent for their living) were given a prominent position in Dr. Gilman's excellent work "A Dividend to Labour," which was fully reviewed in the "JOURNAL" some time since; and to this book we are mainly indebted for the following particulars, which we think will, at the present moment, be interesting, and may well be instructive, to our readers.

Much has been done by the firm to provide good and comfortable housing for their hands; about one-fourth of the number of employees—with their families, say 40,000 souls—being now in occupation of Krupp-owned houses. The firm also, by means of loans on very low terms, make it easy for the men to acquire their own houses. The "Colonies" built near Essen are very pleasantly laid out and conveniently arranged—that for invalid and retired workmen being particularly attractive in appearance. Applications for the houses are so far in excess of the supply, that a man has generally to serve about ten years before his chance comes to be accepted as a tenant. For single men, there are several big "barracks," containing very comfortable lodgings, restaurants, and reading rooms, at which the regulations are of military strictness. The rents only give a return of about 2 per cent. to the firm.

These Colonies obtain all necessaries of life from large stores belonging to the firm, where everything supplied is of good quality, and the profits are returned to the consumers in the form of an annual rebate. In connection with these stores, there are slaughter-houses, flour-mills, bakeries, an ice factory, laundries, tailors' shops, and brush, paper, and shoe factories, with numerous restaurants and coffee houses. At these shops, employment is found for many of the semi-invalid and partially-disabled workmen. Bathing facilities are provided at all the works. The sick and burial fund is liberally supported, and is consequently able to give exceptionally good benefits. The firm possess one hospital, and liberally support others. There is a large pension fund, to which employers and employed contribute equally, and a separate fund for the staff officials, founded by a gift of £25,000 from Herr Friedrich Krupp in 1890. A life-insurance fund has been in existence for 25 years; and the firm contribute one-half of the amount of all the premiums paid. In addition to all other provisions for sickness and so forth, there is a special fund of £50,000 given by the firm, the interest on which is at the disposal of a Committee, whose duty it is to grant extra relief to cases of special need—such as of long and severe illness, where the sick fund benefits appear insufficient. Those who have administered sick funds can appreciate the value of such a fund, properly and carefully managed.

Another fund of £25,000, given by Herr Friedrich as a memorial to his father, is used to assist existing institutions, individuals in great need, or those who desire special education in science, art, or industry. Well-equipped primary and secondary schools have also been provided and liberally endowed, as well

as cookery and domestic schools for the wives and daughters of the hands engaged. Close attention is given to the education of apprentices; and free technical training is provided for the sons of foremen and for workmen who show exceptional ability. A club house for the officials may be mentioned, which has a well-equipped library and reading-room, restaurant, bowling-alley, and good garden attached. Dinings halls are provided for men who live at a distance. The firm allow 5 per cent. on savings deposited with them; and the privilege is largely enjoyed.

These are but brief and not complete, particulars of what the great firm of Krupp, whose head has just been followed to the grave by thousands of sorrowing employees, have done by way of fulfilling their duty towards those whose lives were practically speaking entrusted to their tender mercies. Few employers have the power, or the opportunity, to bestow benefits on anything approaching such a scale; but this is no reason why they should not, to the full extent of their possibilities, follow out the principle. Unfortunately, too few realize their moral responsibilities in this matter. It is in the hope of assisting towards a further realization of what can and ought to be attempted, that we have taken this opportunity of referring to the noble work done by Herr Friedrich Krupp and his father.

COMMERCIAL VALUE OF SCIENTIFIC KNOWLEDGE

Research Chemists to be Appointed by the Gaslight and Coke Company.

In his Presidential Address to the Royal Society, delivered at its annual meeting yesterday week, Sir William Huggins joined the chorus of eminent persons who, during the past year or two, have been endeavouring to impress upon the business men in this country the absolute necessity of a more systematic application of scientific methods, in theory and in practice, to our manufactures and industries. To the plea for increased attention to science in all departments of business, we have from time to time lent whole-hearted support—always giving prominence to the opinion, which we hold very strongly, that in regard to educational reform the impetus necessary in this slow-moving country to bring about any really effective improvement must come from business men, captains of industry. If only employers will (in the language of the advertisements) ask for well-educated employees and see that they get them, the steps necessary for the production of a larger supply of intelligently and usefully educated men will very soon be taken. Then, and then only, will what Sir William Huggins rightly described as "the present inappreciative attitude of our public men, and of the influential classes of society generally, towards scientific knowledge and methods of thought," be radically changed.

Holding this view, we are pleased to give publicity to what we understand is the fact, that the Directors of the Gaslight and Coke Company have recently decided to appoint one or more Research Chemists to carry out investigations and experiments at their extensive chemical works at Beckton, with a view to the more profitable utilization of the products of coal-tar distillation and the other processes now carried out at these works. This is a very welcome move in the right direction. It has long been a reproach to this country that our German neighbours buy our crude tar products and make enormous profits out of the dyes and other articles of commerce manufactured from these products; and it was only in the October of last year that we devoted several columns of the "Journal" to an exposition—first, of the enormous progress of the chemical industries in Germany during the past quarter of a century, and second of the magnificent system of education which has given Germany the supply of trained chemists which has enabled her to achieve that progress. For the five years 1895-9, three of the largest firms in the dye-manufacturing industry in Germany paid not less than 24 per cent., not less than 26 per cent., and 18 per cent. per annum dividends respectively, on capitals amounting in the aggregate to nearly £2,500,000. The total annual production of the German chemical works is now about £50,000,000; and imports are decreasing and exports increasing. Why should this enormous volume of trade and so substantial a percentage of profit from the manufactured articles, for which this country supplies much of the raw material, be allowed to rest quietly in the hands of our German trade competitors? That, apparently, is the question which the Horseferry Road authorities are seeking to answer; and we heartily wish them success in their enterprise, which, as an example to other leaders of industry is of more value than any amount of talking or writing.

If, however, we are to wrest trade from our rivals, or prevent them from seizing ours, we must learn the lesson from Germany that this is only to be done by paying great attention, and devoting large sums of money, to the provision of facilities for obtaining thorough scientific education. Germany has risen to the first rank in chemical industry by means of the men who have been given thorough instruction, both theoretical and practical, at her Universities and Technical High Schools; and we can only fight science with science. We may repeat the question with which we concluded the articles to which reference has been made: Has this country, has the gas industry, nothing to learn from a consideration of the past successes, the present position, and the future prospects of chemical research in Germany?

MUNICIPALITIES AND DEPRECIATION FUNDS.

Of all the various problems bearing upon the ever-present question of Municipal Socialism, perhaps none has given rise to greater controversy than that of depreciation. The profits shown on some municipal undertakings would be a great deal less, and the losses shown on many others would be a great deal larger, if, in addition to loan sinking fund charges, a substantial sum had to be set aside annually out of the returns for the purpose of providing a depreciation fund. The question as to whether such a fund is necessary is therefore an important one. The comparisons so frequently made between company and corporation management—of course, greatly to the advantage of the latter—by the friends of Municipalization would undergo very serious modification (if not, in many cases, an absolute transformation) were this knotty point answered definitely, once and for all, in the affirmative. But, fortunately for these partisans, there is at present no prospect whatever of this happening; there are so many arguments to be adduced both for and against, that anything like a general agreement appears impossible. How diverse the opinions held on the subject are, was well illustrated on Monday of last week, at a meeting of the Society of Engineers, when Mr. C. H. W. Biggs read a paper on the "Depreciation of Plant and Works under Municipal and Company Management," in the course of which he contended that there was no need for municipalities to depreciate as well as to pay back capital. The communication gave rise to a long and interesting discussion, nearly every speaker in which viewed the subject, in some respects at least, from a different standpoint to the others. At the outset, the author disclaimed any intention of taking part in the controversy now going on concerning municipal and company affairs, and said his aim was rather to attempt to define and explain one or two points from whence controversialists could start, for unless there existed such common ground all discussion would, of necessity, be valueless.

It might be asked, Mr. Biggs remarked, what engineers had to do with the question of depreciation; and therefore he would endeavour to state their connection with it. Take the iron or steel used for structural purposes, the engineer in his design calculated the stresses or strains a piece of iron or steel had to withstand. Suppose the load on a beam varied from a minimum to a maximum, the engineer used a factor of safety, and employed a beam which in its initial life would carry a much greater load than the one it was designed to bear. He did this simply because he knew that deterioration of material began from the very moment of its use, and that the life of the material depended absolutely upon the rate of deterioration. As soon as the weakening influences had got rid of the material representing the factor of safety, the structure became dangerous, its useful life was ended, and it should be immediately consigned to the scrap heap. Hence the rate of depreciation in such a case was determined by the rate of deterioration of the factor of safety. Having regard to their "idiosyncrasies in respect to the factor of safety," Mr. Biggs proceeded to divide engineers into the following classes: (1) Those permanently safe, who refuse to be guided by complicated mathematical formulæ, preferring the certainty of safety and long life to everything else. Such gentlemen, he said, have been typical British engineers in the past. (2) The highly mathematically trained gentlemen who will split hairs about the strength of a cobweb, and who preach lightness and elegance—say, in bridge work—using a smaller factor of safety, which they claim to be quite adequate, dubbing all notions to the contrary "old-fashioned." (3) The residuum whose designs are guided by what they imagine their clients will spend, and whose god is cheapness. Many of the second and third class, remarked the author, when taxed with producing short-lived works, were content to reply: "We work for the present, not for the future; futurity has done nothing for us, why should we trouble about futurity?" Such an argument might be smart and witty; but when the case was examined, the benefit to the present generation was doubtful, in that the rate of depreciation was much greater than was necessary. Of course, in some cases length of life depended not only upon the factor of safety, but also very largely upon the methods adopted for preserving the material. Given similar and suitable methods of preservation, however, the author contended that the principal element in length of life, and therefore rate of depreciation, was the factor of safety adopted; and so he claimed that the rate of depreciation depended largely on the engineer.

Turning his attention to the money borrowed by municipalities, Mr. Biggs remarked that this must be divided into two parts: (1) Capital used in (so-called) productive undertakings; and (2) that employed in non-productive works. The whole of this money was, he said, obtained under the condition that a certain definite part must be repaid annually. The rate of repayment, which was settled by the Local Government Board, varied according to the purposes for which the money was obtained. There was little doubt that the fundamental principles underlying the whole of the transactions were that all human works decayed or by the process of discovery required to be superseded, and that no capital expenditure should exist at the period of extinction whether that were due to natural decay or to supercession. This policy the author considered to be a wise one; and he admitted that, in carrying it into effect, it was but natural that the period of

repayment should be rather under-estimated than otherwise, though in trying to be on the safe side there was no doubt that a heavier cost was imposed upon the present generation than upon those that would follow. The ideal method of repayment, he said, would, of course, be to pay an annual sum exactly equivalent to the deterioration in value of the work.

The question of repayment was next considered in connection with the work for which the money was required. Dealing first with unproductive undertakings—such as sewage schemes—it was pointed out that interest and repayments fell solely upon the rates, as also did the upkeep. Mr. Biggs gave it as his opinion that the repayment of capital in such a case was merely a system of depreciation, and was true depreciation, even though the sewers existed and were efficient when the total capital was repaid. If they were in good order and utilized after the period of repayment, this was merely a proof that the rate of depreciation was too great, and that one generation of ratepayers had borne a charge which ought in equity to have fallen upon a subsequent generation. The author said he had never heard it suggested that, besides the upkeep of these works and the repayments of loan, there ought to be a third charge upon the rates to be called by the name of "depreciation." Coming, however, to the productive works, it was recognized that here opinions would differ in a very much greater degree. For the purposes of argument, an undertaking was assumed—say, a tramway—sufficiently productive to pay all the charges upon it. Opinions might differ as to what these charges should be; but the most obvious were: (1) Interest, (2) repayment of capital, (3) depreciation, (4) maintenance—*i.e.*, the cost necessary to keep the whole undertaking in a state of perfect efficiency—and (5) working.

Referring to these charges, the author asked what would be the effect of item (4) upon items (3) and (2). There were, he said, two ways of considering item (4)—firstly, that tramway undertakings were of a permanent character, likely to remain at any rate for a century or so; and, secondly, that they were merely a temporary stop-gap, bad at the best. Personally, he inclined to the latter opinion; but if the tramways were a permanent institution, and were kept in a state of perfect efficiency out of revenue, the rate of depreciation—if depreciation was necessary at all—and the rate of repayment of capital, should be very small, as, whatever the rate might be, it was a tax upon present users in favour of future ones. Turning to the item of depreciation, Mr. Biggs admitted that it was held by a very influential and numerous class that, in addition to maintenance and repayment, a charge under this head was absolutely necessary to put these undertakings upon a sound financial basis; the rate of depreciation suggested being that which, when the initial capital expenditure became extinct, should equal in amount the original expenditure. The contention was that, when the capital was paid off, there should be in hand on depreciation account a sum sufficient to renew the whole undertaking; but this argument he considered to be economically unsound. It was, he said, upon this point that he desired to hear clearly expressed opinions. Assuming, however, that the views just expressed were carried into effect, and that the length of life of a tramway be (say) twenty years, at the end of this period the situation would be as follows: (1) Initial capital account closed by annual repayments; (2) an efficient undertaking maintained in perfect working order out of revenue; (3) a sum of money at the bank or elsewhere equal in amount to the repaid capital. This, he thought, involved a threefold depreciation, each equal in amount to the original capital—the original capital would be depreciated out of existence, the maintenance cost must amount to the same as the original capital, and there would be cash in hand equal in amount to the original capital. Those, therefore, who insisted that municipalities must depreciate as well as pay back capital ought to have very strong reasons to warrant such an extreme position; but the author remarked that he had never heard of any reasons being given. The result of the combination of repayment, maintenance, and depreciation would be that the users of the undertaking during the first twenty years of its existence would not only have to pay the working cost and the interest on capital, but an amount equivalent to three times the capital in addition; while at the end of this period, assuming that it was not necessary to further increase the sum obtained by depreciation, they would have to pay the working and maintenance costs. In other words, the initial users would have been mulcted of large sums in order to benefit subsequent ones. As regards the double payment of capital—namely, by repayments and by maintenance—Mr. Biggs confessed that he could see no way out of the difficulty; but in his opinion the insistence upon depreciation, as well as repayment of loans, was absurd, and the only possible motive for the suggestion was an insidious attempt to handicap a municipal undertaking because it was a municipal undertaking. Upon this portion of the paper, the questions submitted for discussion were: (1) Is efficient maintenance—as is absolutely necessary in productive undertakings—a capital or a revenue charge? If the latter, is not that one method of depreciation? (2) Is the repayment of capital depreciation? If not, what is it? (3) If capital is repaid, is further depreciation necessary? If so, why?

So much for municipalities. Let us now see what Mr. Biggs had to say with regard to similar points as affecting companies. Assuming an ideal case, whereby a company would obtain the same amount of capital as an authority—that is, the total money obtained would be expended on the work done without allowing any diminution for promotion or watering, thus leaving the total capital available for the cost of the actual works—and the working costs would be the same, the question would then arise: "Does the management differ?" There could, he thought, be but little doubt that the expenses of company management were largely in excess of those of a municipality, and hence the amount of revenue divisible was by so much lessened. What was done with the divisible residue? In the first place, the undertaking had to be kept in a state of efficiency; and then came the questions of reserve, depreciation, and dividends. As to the latter, if the dividends of a company were more than $3\frac{1}{2}$ per cent. (the interest on the capital of an authority), it might be contended that all over this rate was merely another form of repaying capital, and that companies paying more than $3\frac{1}{2}$ per cent. were in this way doing exactly what municipalities did. If the shareholders were to invest at compound interest all they received over $3\frac{1}{2}$ per cent., they would at the end of a certain period have a sum at the bank to their credit equal in amount to the capital they put into the scheme. If, further, the company placed the amount allowed for depreciation to reserve, they would gradually accumulate funds which in time would equal the original capital. So they would come to the same point as the municipalities—that is to say, (1) the capital would have been repaid, by the shareholders receiving an increased interest; (2) it would have been repaid by keeping the undertaking efficient out of revenue; and (3) it would have been a third time repaid by the amount allowed for depreciation and credited to reserve, such funds accumulating until the amount of the original capital was reached.

After touching upon the probable low charges to users by municipalities when the capital was repaid, as compared with those which companies would no doubt continue to levy, Mr. Biggs remarked that probably his views would be combated by the statement that maintenance was but partial, and not complete as suggested, and that efficiency was not maintained in either case out of revenue in perpetuity. Even should this turn out to be so, however, it would merely modify what he had said, unless the cost of maintenance and depreciation were so proportioned that together they only equalled the repayments, which he quoted examples to show was not the case. It was abundantly clear, he argued, that whether the accounts of a municipality or of a company were considered, the profits they were endeavouring to make in this particular direction were excessive. The goods they had to sell were therefore too dear, and the buyers were unduly penalized.

In conclusion, Mr. Biggs said that the average interest obtained for gilt-edged securities might be taken as the natural rate of interest; and if a higher rate than this were obtained, it should be taken as repayment of capital, required because of the greater speculative character of the investment. Local authorities borrowed at from 3 to $3\frac{1}{4}$ per cent. interest, and reckoned that 6 per cent. per annum would pay interest and instalments of loan; and, if this were so, it was surely just to look upon a company's 4, 5, or 6 per cent. per annum dividend in a like manner as part interest and part repayment of capital. "Are we not," he asked, "in connection with capital repayment, maintenance, and depreciation, creating a new phase in business accounts?" Although, said Mr. Biggs, the economic theory was that a thing was worth what it would fetch, the artificial restriction of competition unduly penalized the present user.

This completes our summary of the views expressed by the author of the paper on the subject dealt with. Next week we shall hope to notice a few of the more important arguments adduced by the speakers in the subsequent discussion.

The Late Sir F. Abel.—The estate of the late Sir Frederick Abel, Bart., who died on the 6th of September, has been valued at £21,082 gross and £20,798 net.

Professor Lewes's New Course of Cantor Lectures.—The third of these lectures was given at the Society of Arts last night, when Professor Lewes dealt with the relation of the candle power and calorific value of gas to its use with the incandescent mantle, the directions in which this valuable modern auxiliary in the production of light will be improved, and the probable future of coal gas. A full report of the lecture will appear next Tuesday.

Societe Technique du Gaz en France.—We have received the "Transactions" of this Society for the present year. The volume contains the report of the twenty-ninth annual congress, held in Paris last June, under the presidency of M. Piaton, most of the papers read at which have been noticed in the "JOURNAL." The supplementary matter comprises some sympathetic references to the late M. Alavoine, a former President, on the occasion of his funeral; lists of the prizes offered by the Society, and of the winners since its foundation, as well as of the officers and members. An interesting feature of recent volumes is the table of symbols and abbreviations which the writers are requested to adopt in papers presented to the Society; and it is followed by another summarizing M. Violle's comparisons of the various photometric standards. M. Victor Delahaye continues his review of the principal legal cases in the past and preceding year, and, as before, gives a list of those dealt with since these useful summaries were commenced in 1886. The papers are illustrated by 26 folding plates; and the entire contents form a bulky volume of 722 pages, compared with 580 pages last year.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1559.)

THE Stock Exchange had another very poor time of it last week. The public steadily refuse to do anything, and all the markets suffer from atrophy. Prices were fairly steady at first; but they had to give way later on. There is not much chance of any improvement before the end of the year—indeed, the probabilities are, if anything, in the other direction, especially if there should be a rise in the Bank rate. There was hardly any change in the Money Market, though at first the tendency was rather easier. But it quickly steadied again, and discount rates were steady too. The Gas Market was interesting, and more active; there being an especially large number of transactions in issues which had been sharply hit the week before. Then nearly everything fell freely; but this time the pendulum swung the other way, and changes of quotation, though neither numerous nor for the most part considerable in degree, were all in the upward direction. In Gaslight issues, there was a large mass of dealings in the ordinary. It opened just as weak as it had closed, and once changed hands at 83, but that was the dead bottom-price, low enough to attract buyers, and so a recovery set in. On Friday, 85⅜ was marked twice; and the marks on the closing day were satisfactory. The secured issues were quiet, but prices were much stronger, more especially for the preference, which recovered the point it had lost the previous week. South Metropolitan opened at 119, and looked as if it was going to improve. But there was no adequate demand to give it a chance, and it could not get more forward. In Commercials, there were only two little lots done at "special" prices. In the Suburban and Provincial group, transactions were very scanty on the Stock Exchange, though in the Mart large parcels were readily taken up. The feature was the advance of Brentford preference by nine points, which is on a level with the Gaslight preference, and is no higher than it deserves to rank. On the local Exchange, Sheffield "C" advanced a point. Business was only moderate in the Continental Companies; but prices were steady and unchanged, except for a smart advance in Cagliari. Among the undertakings in the remoter world, the only movements were improvements in the debenture issues of Companies in Argentina. There was nothing to chronicle in connection with the Water Companies, except a little advance in East London. The London Water Bill is now on; and until they get some sort of inkling which way the parliamentary cat is going to jump, the Companies are likely to be quiet.

The daily operations were: Fairly active movement in Gas on Monday, but prices were rather poor. Gaslight ordinary fell ½. Tuesday was quieter, and nothing moved. Wednesday also was quiet, but there was a brighter tendency. Gaslight ordinary recovered ½. On Thursday, there were very numerous dealings in Gaslights at better figures, and the preference rose 1. Brentford preference gained 7, River Plate debenture 2, and Buenos Ayres debenture 1. Friday was firm and buoyant. Brentford preference and Cagliari rose 2 each. Gas was unchanged on Saturday; but East London Water improved 1½.

ELECTRIC LIGHTING MEMORANDA.

Mr. James Swinburne on the Limits of Electrical Engineering—Economics of the Utilization of Waste Power—The Large Gas-Engine—A Dublin Controversy.

MR. JAMES SWINBURNE delivered, last Thursday evening, his address as President of the Institution of Electrical Engineers. He took for his main subject the limits recognizable in heavy electrical engineering; remarking that progress in this line has been so rapid lately that there may well be vague views of what can and what cannot be done electrically. Giving attention first to the question of mechanical power and its sources, Mr. Swinburne disposed of the fancy that the tides can ever be utilized as a source of energy, and discussed water power in the cold light of reason. In the course of his argument, he took occasion to show that the cost of power in most industries is a much smaller item than is generally supposed; so that it does not pay to start a works in an otherwise not perfectly suitable locality merely for the sake of cheap water power. This is so even in the extreme case of calcium carbide manufacture, in which at first sight the power seems to be the main element of cost. Differences in local cost of coke, lime, and labour, coupled with cost of carriage, may easily swamp every consideration relating simply to the cost of power. Mr. Swinburne has a philosophic turn, and loves to take broad views—so long, that is, as they are as deep as they are broad. That is the difference between a witness to the truth of a great matter of his quality, and a mere smatterer. Their sayings may sometimes be superficially alike; but in following Mr. Swinburne's sweeping generalizations, one knows all the time that they have the deepest possible foundations.

Dealing, for example, with one of the most vexed questions that ever come before the engineer—the economics of "utilizing" arrangements, such as the harnessing of water powers, or the saving of the wasted energy of blast-furnace gases. There is something, as Mr. Swinburne observes, in this idea that appeals strongly to the half-scientific or unpractical mind. But this process of utilizing what is running to waste cannot be done for nothing. Capital must be spent on the necessary works, which calls for interest and depreciation allowances. After this, the value of the thing saved will be found to have risen. Ricardo's theory of rent is as applicable here as it is to arable land. The landlord, or first owner, will want most of the improved worth of the utilized property as rent. "For a water power to be really valuable, it should be near a source of material, on the sea, and should have a great head of water, so that the capital cost of development is small. Such a water power is very valuable—to the landlord. A blast-furnace is more valuable than a water power. There are plenty in England. But the owners, who have been wasting the gas up to now, will not give it away. They will want rent, so that it will only just pay to use his gas, rather than make it." This is the truth of the matter, in a nutshell. Mr. Swinburne proceeded to demolish the notion that electricity may be obtained directly from coal, pointing out why a carbon cell—an electrolytic cell in which the consumed electrode is carbon—seems impossible. It is because, in the light of modern theory, carbon never forms ions, and has no solution pressure, and can therefore give no electromotive force.

Mr. Swinburne turned at the culminating point of his argument to the gas-engine, saying, in his own brilliant way of lighting up a big subject with a luminous sentence, that "with very cheap gas, the first thing is to make big engines; the next to make them so that they never break down; and the last thing to make them efficient." With submission, this is precisely the same view of the progress of gas-engine construction that has been expressed in our own recent articles on the subject. It is by virtue of neglecting the economy of heat, over which engineers once boggled to the verge of becoming impotent for advancing, that makers of big gas-engines succeeded. Mr. Swinburne thinks there is still plenty of room for improvement of the gas-engine, which is in very good hands for the purpose. As to electrical machinery proper—dynamos and so forth, including conductors—he does not see any prospect of very much advance on established practice. A further improvement in secondary batteries might produce very great changes in important branches of engineering; and insulation greatly needs improvement. As to electric light, here the inefficiency and waste are prodigious; and although this condition is mostly unavoidable, there is still great room for improvement. The address concluded with a few thoughtful words on the electrolysis of pipes underground, which Mr. Swinburne confesses is a very difficult question.

A bright little controversy has been going on in Dublin over the comparative local prices of electric and gas light and power. The Corporation have issued the usual circular, giving the hoary old misstatements on the subject, which no electricity supplying local authority seems to be able to do without. No such body has ever heard of incandescent gas lighting, although it stares them in the face on every side, and is bound to tell upon their business in the long run. The Dublin Corporation have gone several points better than the record in this latest performance of theirs, inasmuch as they are advertising a scale of prices for electricity which is not to be available before next July. Truly, Irish Time has a very long forelock! Mr. Francis T. Cotton, the Secretary of the Gas Company, has obtained the publicity of the "Freeman's Journal" for a true comparison of the cost and lighting effect of incandescent gas and electricity, which, of course, the Editor of the newspaper, who devotes a leading article to the subject, cannot and will not credit. He declares that the statement that the electric light is seven times more costly to the user than Dublin gas is an assertion "that will beggar credibility." Of course, he forgets that the basis of the statement is equality of lighting effect. What he is thinking of is the usual lighting bills paid by consumers of gas and electricity respectively, where this condition of equality is not observed. Then, it is true, as the newspaper avers, the frugal householder finds electricity "somewhat more costly" than gas at Dublin prices. But although the exact comparison of the cost of equal lighting by incandescent gas and incandescent electricity is really as Mr. Cotton has stated it, one can barely wonder that it is too much for a non-technical person to swallow. We saw the same incredulity manifested the other day by the "Electrician" in regard to the Crystal Palace example. But the stubborn fact always and everywhere asserts itself. The incandescent gas-burner simply makes the low-power incandescent electric lamp impossible for business purposes. Electricians may offer the public calculations based on an imaginary 8-candle lamp, which is of no use; but the 60-candle power or thereabouts of the incandescent gas-burner is the real rival they have to reckon with. This it is that puts out of use the incandescent bulbs in shops, hotels, and everywhere where good lighting at a reasonable cost is an essential. Combination fittings for gas and electricity are common enough; but when they are found it is only the gas that is used. The electric lamps are not bright enough, at the price people are prepared to pay; and nobody who has not private generating plant can afford to use nominal 60 and 100 candle incandescent lamps which are of equal brilliancy with incandescent gas. The "Freeman's Journal" may not like the facts any more than the "Electrician" did; but there they are, and the public soon learn the truth.

The Institution of Gas Engineers was registered on Nov. 29 as a "guarantee company, each member of which is liable for the sum of £1 in the event of winding up." The registered office is No. 39, Victoria Street, Westminster.

HISCOX ON THE GAS-ENGINE.*

When a text-book on any engineering subject can appeal to the public with a tenth edition, entirely "reset," and claiming to be completely "up to date," the voice of criticism should be hushed. Yet, upon taking up this book, we must confess to a feeling of distaste for it, proceeding entirely from the clumsiness of the author's style, which is anything but good English. It seems very odd that if a man takes the trouble to write a book, he should not also take pains to do it reasonably well. Yet a certain class of American authors appear to be either incapable of expressing themselves in English, or careless as to the meaning and disposition of the words they employ. Mr. Hiscox is one of these Americans, who write in what reads like a bad translation of some unknown tongue into something that looks like English but is not. Take this sentence from his preface, for a taste of his quality as a writer: "The ideal of a prime moving power, so cheap, so safe and so easily managed, that is now in successful operation, and that has culminated in its real growth in the past quarter of a century, marks an epoch for the beginning of the twentieth century, that is a marvel in promoting our industries by the use of this new and economical power." What is the sense of this farrago of words? We say plainly that gas engineers cannot welcome a badly-written book, such as the one before us. We think, also, that no English publishing firm should put forward an American technical book without acquainting possible purchasers with its origin. There is, and ought to be, a great difference between the American and the English view of gas-engines, and it is not fair to the public to leave it to be found out from which side of the Atlantic a book on the subject is composed. Having made this protest against the author's bad writing, and the publishers' omission to signify the fact of the book being American, it is incumbent upon us to ascertain if its merits, such as they are, outweigh these drawbacks to its acceptability with English students of this order of technical works. Beginning with the author's introductory chapter, this is the kind of remark we find: "The best steam-engines now made run with a consumption of about one and three-fourth pounds of coal per horse power per hour; while from two and one half to seven pounds is the cost (*sic*) of power per horse power per hour in the various kinds of engines now in use." Then he tells his reader that "the internal-combustion engine has come seemingly like an avalanche of a decade," whatever this may be intended to mean. No; we cannot advise any student to spend money on the purchase of this book. It is a pity, for the author seems to know something about gas-engine details as used in the United States. He constantly refers to American makers of gas-engine parts—valuable local information, doubtless, but no recommendation of the book as imported.

PERSONAL.

Mr. H. E. S. Baker has tendered his resignation as Engineer and Manager of the Reading Gas Company.

Mr. J. W. Napier, who has been appointed Manager of the Alloa Corporation Gas-Works, was presented last Wednesday by the employees of the Carnoustie Gas Company, with handsome tokens of the esteem in which he is held by them.

At the monthly ballot for membership of the Institution of Civil Engineers last Tuesday, Mr. W. M. Bergin, who is engaged on the Derwent Valley water scheme, and Mr. T. Molyneux, of the Stockport Corporation Water Department, were elected associate members.

There has been a change in the management of the Colney Hatch Gas Company. Mr. W. F. Broadberry has resigned the appointment, and Mr. J. Mitchell has succeeded him. Mr. Mitchell has been an assistant to the Manager of the Hornsey Gas Company for the past seven years.

Mr. J. W. Helps, the Engineer and General Manager of the Croydon Gas Company, has just been entertained, with other gentlemen, at a complimentary banquet by the members of the Thornton Heath Ratepayers' Association, in celebration of his victory at the recent municipal elections.

The Directors of the Newquay and District Water Company have made a change in the administration of their affairs, and have placed the secretarial duties, as from the 1st prox., in the hands of Mr. George G. Bullmore, the local Manager of the Newquay Gas Company, Limited. Both Companies are working under statutory powers.

With reference to the paragraph in last Tuesday's "Journal" announcing the conditional appointment of Mr. Percy C. Holmes Hunt as Assistant-Engineer to the Melbourne Gas Company, we are pleased to learn that the condition has been satisfactorily fulfilled. We heartily congratulate him, and offer him our best wishes for a successful career.

Mr. A. Mackenzie, the well-known and popular representative of Messrs. Alder and Mackay, of Edinburgh, celebrated his twentieth year "on the road" for the firm, by giving a dinner to a large number of friends in the Alexandra Hotel, Bath Street, Glasgow, last Wednesday. A company numbering about eighty, mostly gas managers, responded to the invitation; and a very happy evening was spent. In addition to the hearty congratulations of those who were present—and these were, deservedly, of the most friendly description—there were regretful apologies for absence from a number of gentlemen, one of whom couched his observations in happy rhyming phrase.

It will be seen by the report of the proceedings of the Birmingham City Council last Tuesday, which appears in another column, that Mr. F. W. Macaulay, M.Inst.C.E., has now been appointed Resident Engineer of the Elan supply works. The appointment has been necessitated by the approaching completion of several of the contracts, and the consequent termination of the responsibility of the Constructing Engineers. The new Resident Engineer will be head of the permanent staff in the Elan Valley, on the aqueduct, and at the Frankley reservoir; and his duties will comprise the supervision of the whole of the Welsh scheme, from the sources to the commencement of the distributing mains. He will be stationed at Ludlow, or at some other convenient point approved by the Water Committee.

NOTES.

Determination of Sulphur in Coal.

Writing in the "Journal of the American Chemical Society," Mr. C. W. Stoddart gives an account of some comparative determinations he has made of sulphur in different kinds of coal, with the object of ascertaining which method is the most generally applicable for rapid work. From the results thus obtained, he concludes that the standard method of combustion in oxygen in a bomb calorimeter under pressure is accurate with the most varying types of coal. Of the more practical methods, that of Eschka was found to be the best, provided the silica was dehydrated and separated. The other methods tried—viz., those of Stolba, Antony and Lucchesi, and Thomson—gave good results with certain coals, but were less reliable than the two preceding methods. Hodgson's method, consisting of fusion with sodium peroxide, was found unsatisfactory; the results being too low.

Micro-Organisms in Water.

In the course of a communication published in the Transactions of the American Microscopical Society, Messrs. Whipple and Parker discuss the connection between the amounts of oxygen and carbonic acid dissolved in natural waters and the occurrence in these of microscopic organisms. "Nature," in noticing the authors' work, points out that it has long been known that exhaustion of nitrates takes place in ground water supporting a vigorous growth of algæ; and it has been assumed that nitrates are the fundamental factors in their development. Nitrates are indeed of some value; but the inadequacy of this explanation became manifest when it was observed that some water, comparatively poor in nitrates, at times supported large growths of algæ. The authors' point out the apparent importance of carbonic acid, and express the opinion that the algæ are influenced by it more than by the nitrates.

Tar Pavement Bicycle Tracks.

Some interesting observations on the laying of asphalte or tar paving bicycle paths occur in a reported discussion of the subject of the maintenance of asphalte street pavements held by the American Society of Civil Engineers. It was stated that in one of the suburban boroughs of New York, quite a large number of asphalted strips for the use of bicyclists have been constructed in the roadways of the different streets and avenues. They are usually from 3 to 5 feet wide; the rule governing the width being that both wheels of an ordinary road vehicle shall not be able to get upon them. In those cases the strips were formed upon a basis prepared by sufficiently lowering the ordinary road surface, so that they conformed to the cross section of the roadway; and they are mostly situated next to the kerb. The result has been to show that such a cheap and easy way of preparing a cycle path is not advisable. The maintenance of the strips has proved very expensive, by reason of water getting under them from the remainder of the road, which is, of course, higher. Ordinary tar paving disintegrated under this condition of usage, and would not hold together. Another point was that the usage of bicycle wheels only is not sufficient to sufficiently consolidate a tar paving surface. Such a pavement does better with an adequate amount of rolling in daily use, to compress the surface and keep it impermeable. The problem of finding a more suitable surface for light traffic remains scarcely touched.

An Improved Coal Calorimeter.

In the current number of the "Electrician," Mr. E. E. Fournier d'Albe gives, among his notes on "Contemporary Electrical Science," one on an improved coal calorimeter by Mr. W. Rosenhain, described in the October number of the "Philosophical Magazine." It is based on the instruments of Thomson and Hudson-Beare, but better adapted to factory use. The coal is

* "Gas, Gasoline, and Oil Engines. An Up-to-Date Book on the Subject of Explosive Motor Power for Stationary, Marine, and Vehicle Motive Power." By Gardner D. Hiscox, M.E. With 312 Illustrations. London: Sampson Low, Marston, and Co.; 1902.

burnt in a stream of oxygen while enclosed in a chamber immersed in the water of the calorimeter. The calorimeter, therefore, consists of two essential parts—a vessel for containing the water, and a chamber in which the combustion takes place. The former is a rectangular vessel of sheet brass, containing about 2½ litres of water; while the latter is much smaller, and is made principally of glass, and provided with a set of pipes and valves for the admission of the oxygen and the escape of the products of combustion. The brass calorimeter vessel is provided with two opposite windows, which allow a full view of the interior and of the progress of the combustion. The combustion chamber is formed by a lamp chimney (preferably a Jena one), closed at the top and bottom by brass plates with the various attachments. The oxygen enters through a rose nozzle in the centre of the chimney, and flows down to the specimen of coal; and the gases then emerge into the water of the calorimeter. The combustion is started by an electrically heated platinum wire.

Petaval on Standards of Light.

Mr. J. E. Petaval, of Manchester, is engaged upon the study of absolute standards of light, and has reproduced Violle's standard of solidifying platinum. This arrangement does not satisfy him; and he has accordingly described to the British Association the further steps which he has taken in the direction of producing something more acceptable in the same line. As a preliminary research, Mr. Petaval has investigated the intrinsic brilliancy of the platinum metals in the molten state, and gives the following formula for the relation between the temperature t in degrees Centigrade, and the intrinsic brilliancy b in candles per square centimetre, $b=(t-400)^{6\cdot2}$ C. This formula holds strictly for platinum up to its melting point; and the constant C has in this case the value 889·6. Platinum melts at about 1750° C.; and Mr. Petaval made experiments with iridium, and its alloys with platinum, which have much higher melting points. The melting point of iridium is 2423° C.; but it begins to fume before it fuses. The inconvenience of these molten metal standards induced the Reichsanstalt some years ago to try a slip of platinum raised to incandescence by a current of electricity, and absorb most of the radiation by causing it to pass through a layer of water contained in a quartz trough. As it is very difficult to ascertain the exact amount of the absorption, Mr. Petaval struck out a new line. He observed that most substances transmit more of the light radiated from incandescent platinum the higher the temperature of the radiant; but there is an exception, black fluorspar, which acts in the opposite sense. This behaviour of black fluorspar has enabled Mr. Petaval to construct an apparatus giving radiations at constant temperature. It consists of two thermopiles in opposition—one measuring the radiation through glass, the other through black fluorspar. At a particular critical temperature, the two currents, one of which increases while the other decreases with a rise of temperature, will balance one another. That temperature will be a constant one for a given disposition of the apparatus; and as often as it is reproduced, the radiation must be the same. Mr. Petaval hopes to be able to stamp a standard—say, of 1·432 candles—by his method.

Result of a Road-Oiling Experiment.

A good deal of interest has naturally been aroused by the experiment in road oiling carried out last summer in the Aldershot district by the County Surveyor of Hampshire. The practice has been mentioned from time to time in this column, chiefly with reference to Californian experience. Conflicting accounts of the results of these experiments have come to hand; but, on the whole, they appeared to be fairly satisfactory, under the conditions of an intensely hot and dry climate, with lack of both money and water to lay the dust of the roads in the usual way. The subject of laying the dust on English country roads has attained greater importance since the introduction of motor cars, the pneumatic tyres of which are very destructive to ordinary macadam; and it was hoped that a remedy for the dust nuisance might be found in the application of heavy petroleum. Accordingly, a stretch of the much-frequented London and Southampton road in the sandy region between Farnborough and Aldershot was treated simply with Texas oil at the rate of 2500 gallons to three-quarters of a mile. The distribution was effected first by means of a watering-cart, and afterwards the ground was gone over by men with oil in watering-cans. The oil appeared to soak quickly into the road, leaving a clean and firm surface on which motor cars did not raise any dust, while clouds of it arose from the untreated road before and after. So long as the dry weather lasted, the surface answered the purpose. Unfortunately, as soon as wet weather set in, the surface cut up badly, and did not dry well. In fact, the oiled portion of the road was found to be rough and badly rutted, while the remainder was quite dry and smooth. The Surveyor to the Farnham Rural District Council has reported that in wet weather the oiled road became a mass of slimy mud—the mixture of water and oil producing a vile compound. The effect of this kind of dirt upon carriages and clothes must be disastrous. It is observed by the "Ironmonger," commenting upon this result, that it looks as if the only practical solution of the problem of highway improvement to satisfy the needs of modern traffic must be sought in the use of materials for road making quite different from those now in vogue. In the circumstances, increased interest attaches to the experiment of the Nottinghamshire Council with slag and coal-tar macadam.

COMMUNICATED ARTICLES.

A NEW METHOD OF CONSTRUCTING TANKS.

By Arthur Vye-Parminter, of Paris.

A new and economical method of constructing gasholder tanks is coming into use on the Continent, and has already attracted considerable attention from engineers in England. It is known as the "Cottancin" system of steel-cored brick and steel-cored cement construction, and it has been largely used in France for building circular and other reservoirs. It is specially adapted to gasholder tanks by reason of the security afforded against any possibility of leakage or any danger of cracking or the sudden giving way of any portion of the tank, however great may be the pressure on the inside.

The Cottancin system was first employed for gasholder tanks by the Paris Gas Company, who do not adopt any new form of construction unless it has received the careful examination of their special engineers. In this case the work consisted in rendering perfectly water-tight the gasholder tank at the Company's works at Alfortville, having a capacity of 2,200,000 gallons, an interior diameter of 95 feet, and a depth of 23 feet. The tank, notwithstanding the thickness of 9 ft. 10 in. of masonry and concrete of which it was constructed, was split in the whole of its depth, though it had been built with the great care always taken by the Company in carrying out their work. The crack was so serious that, in order to avoid further danger, it was necessary to empty the tank. The Company were rather at a loss as to how to remedy the defect, since all repairs made by them to other tanks which had become cracked in a similar manner had been found to be ineffective.

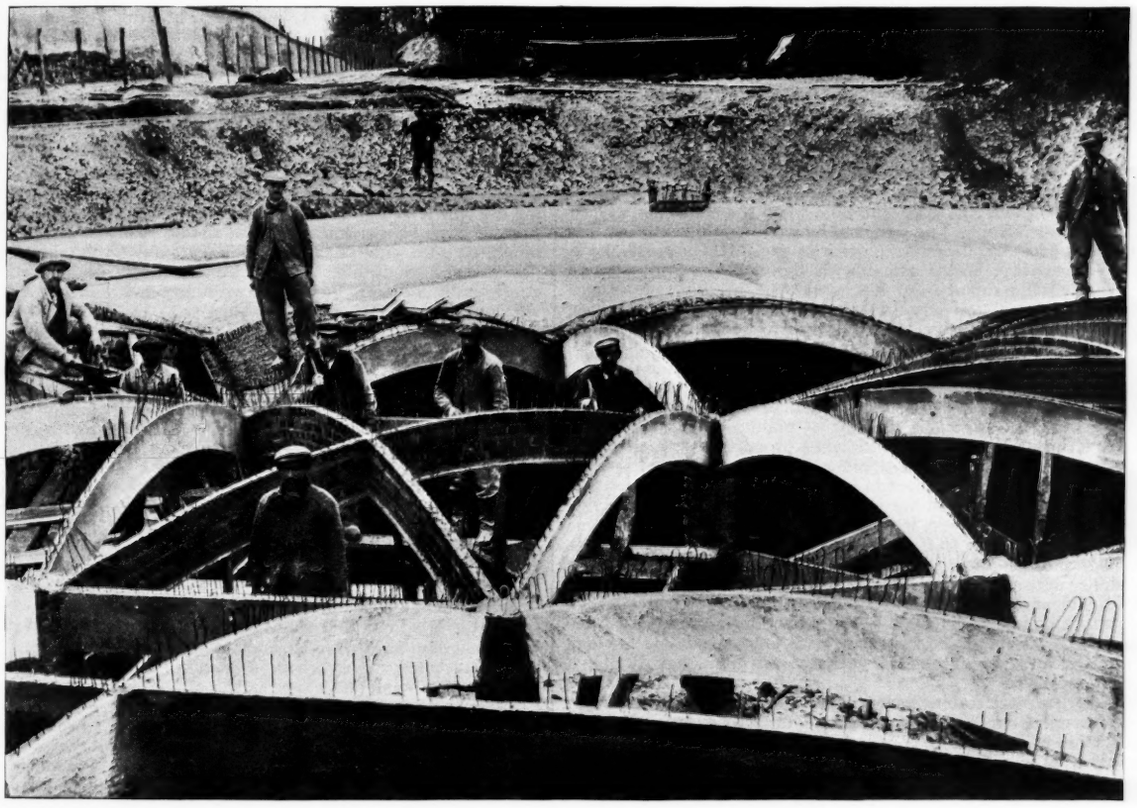
After considerable study, they decided to employ the Cottancin system as a remedy, more especially because it had been successfully applied to a large tank belonging to the St. Germain Gas Company at St. Germain-en-Laye, which had split and had remained in an absolutely dangerous condition until the Cottancin system was resorted to. This tank, which was 69 feet in diameter and 22 feet deep, had been lined throughout in the interior and bottom with a 2-inch thickness of steel-cored cement, on the Cottancin system, with perfect success, despite the strain to which the tank was subject, and without removing the holder. A similar success with the gasholder tank at St. Omer led the Paris Gas Company to employ the system for rendering water-tight their tank at Alfortville. This tank was lined throughout with a 2-inch thickness of Cottancin steel-cored cement, with a success equal to that of the other tanks mentioned. The tank thus treated was found to be so perfectly water-tight that it has been necessary to form an overflow near the top, to let out the accumulation of water after rainfall.

This system, therefore, employed for the lining of existing tanks, offers great advantages and security to gas companies, and permits the suppression of the use of steel tanks in elevation, which, while very costly in the first place, are by no means durable, and besides present a certain danger. Economy and solidity may be secured by the employment of the Cottancin system of steel-cored cement materials for the construction of these tanks, instead of the heavy masonry now used. The tanks are constructed of a thickness of 4½-inch steel-cored brick in cement, offering great resistance by reason of the metallic core which runs through the whole of the brickwork after the manner of basket-work. This circular brickwork wall is reinforced by means of exterior vertical and horizontal ribs of steel-cored brick, the core of which is tied to that of the circular wall. All concrete or masonry foundations are done away with, and replaced by a shallow foundation or platform of steel-cored brick and steel-cored cement caissons on the Cottancin system, arranged in such a manner that settlement is impossible, however bad the soil may be. The steel core of the caisson platform is so combined with the cores of the circular walls and the ribs above, that extraordinary strength and resistance are obtained.

These platform foundations have also been employed for a large number of important buildings where it was found that, owing to the softness of the soil, ordinary foundations would have been too costly, or would afford insufficient security. This is the case with the foundations of the Casino and Thermal Establishment of Enghien, near Paris, built on the mud of the lake of Enghien; the Nouvelle-Sadikia, or public schools, at Tunis, built on upwards of 200 feet of made soil; and the new legation at Tangiers, built on the shore of the Mediterranean. The new church of St. Jean, at Montmartre, among others, is erected on these caisson foundations on the treacherous soil of the hill. An important church built upon similar caisson foundations, and to be constructed entirely on the Cottancin system, is now in course of erection at Exeter. A large number of circular reservoirs have been entirely constructed on this system, consisting of 4½-inch, and in some cases 2¾-inch, circular containing walls of steel-cored brick, founded on a shallow caisson platform of steel-cored brick and steel-cored cement, with covering of similar materials, with the steel core or trellis of steel wire forming a continuous basket-

work throughout the whole of the reservoir—thus uniting the foundations, walls, pillars, and covering in one structure of extraordinary strength. The application of the same method to the building of gasholder tanks should have an interesting future before it.

[Our correspondent, in forwarding the photographs from which the above illustrations have been prepared, says they are views of a large circular reservoir at Nemours, France, built entirely on the Cottancin steel-cored brick and steel-cored cement systems. One shows the construction of the bottom of the reservoir, formed of shallow steel-cored brick caissons, with platform surface of steel-cored cement, the core of which is tied down to the cores of the brickwork. A portion of this photograph shows the trellis-core of the cement panel being put into place. The circular containing wall shown in another photograph is built of steel-cored brick 4½ inches thick. In the case of gasholder tanks, the exterior of this wall would be reinforced with vertical and horizontal ribs of steel-cored brick. The pillars are of 14 in. by 14 in. steel-cored brick, and the covering is of 2-inch thick steel-cored cement supported by steel-cored brick and steel-cored cement ribs, as shown in the photographs. The steel core, consisting of soft steel wire, woven into panels or threaded in the brick to meet the various strains, runs continuously through the caissons, wall, pillars, ribs, and covering, and thus forms a whole of extraordinary strength.]



THE COTTANCIN SYSTEM OF TANK CONSTRUCTION.

LEAKAGE OR PREVENTABLE WASTE.

By C. E. JONES, Assoc.M.Inst.C.E.

"Dividends are made in the retort-house," is an aphoristic saying worthy of acceptation. Formerly it signified a large production of gas per ton, and the estimable manager of the old school who made it was advanced a head and shoulders above his admiring though less fortunate *confréres*. Like many proverbial expressions, however, it should not be too literally taken, since it has its antithesis in "Dividends made in the retort-house are dissipated in the streets."

A modern gas undertaking is a complex machine of many parts; and thorough efficiency—in contradistinction to partial success—can only be secured by taking care that every part of the mechanism is proportional and performing its allotted functions. This applies, by the bye, not only to thermo-dynamical science, mechanical powers, or ingenious appliances, but also to the animated and admirable machine, the *genus homo*, whose delicate organization is likewise liable to derangement. Efficiency in the retort-house, which may be termed the heat-engine of the whole

enterprise, is indispensable to successful working; and even now, after about a century of experience, champions of "inclines" and "horizontals" are doing battle with as much ardour as the late goliaths of the iron *versus* clay retorts ever displayed on behalf of their respective systems. Neither are the claims of water-gas suffered to lie dormant.

But perfect carbonization *per se* will not manufacture payable dividends. They become an aggravated loss unless accounted for, and paid into the exchequer. Before this can be achieved as it should be, the mains and services—the distributory parts of the machine—must be perfect. Are they perfect? Few experts, after studying the question, would have the hardihood to declare that they are. On the contrary, they would not hesitate to affirm that they are in an unsatisfactory condition and in the majority of cases the weakest part of the machine—inviting improvement and demanding directorial attention. The carbonizing test of efficiency is a good one so far as it goes. It is not intended to disparage its importance; but it is nevertheless not the all-in-all—the *ultima thule* of gas administration. A better test of due care and management is afforded by the ascertainment of the gas made, sold, and paid for, per ton of coal carbonized. This crucial trial brings to light many hidden things, and discloses the sources of loss, euphoniously designated "unaccounted-for gas," but which for the most part is preventable nevertheless. This leakage is continually absorbing the profit of the shareholder, and postponing to the "Greek Kalends" the time when the consumer will be rewarded for his confiding patience by participating in the profits by means of a reduction in the price of gas. His interests, he is assured verbally, are identical with those of the purveyors of his gaseous illuminant; but his confidence in such assurances cannot be considered enthusiastic, and may be misplaced. So, looking askance at coal gas, he proceeds to adopt a rival illuminant, and by avoiding Scylla falls into Charybdis.

To strain after a large yield per ton in order to feed leakage is, apparently, a Sisyphian labour to which many undertakings are condemned; and so-called dividends made in the retort-house are wasted in the worst possible form—polluting the atmosphere, endangering human life, jeopardizing property, increasing fire-risks, and accelerating the depletion of our coal-supply, while keeping up the price of the "black diamond." Causes of waste are well understood, and need not be discussed here; but when leakage becomes chronic, it behoves us to overhaul the machine and find a remedy. In the interests of the proprietors, the consumers, and the general public, it is imperative that this should be done; but it is doubtful if such companies as those paying full dividends, and retaining power to raise the price of gas, will take the initiative in this matter. Well-to-do undertakings are usually content to let things alone—"sufficient unto the day is the evil thereof;" and, pending some eruptive catastrophe, they dwell in a fool's paradise.

Truly gas undertakings possess a vast reserve of power in "unaccounted-for gas," financial and otherwise; and when its utilization is determined, not the least effect will be to relieve the coal market and cheapen the raw material. It would be a comparatively easy task to demonstrate that some towns are sustaining a loss by leakage equivalent to a money value of 4 to 5 per cent. interest on the capital subscribed, or that they are carbonizing thousands of tons of coal yearly to supply leakage, or gas not accounted for. These are not mere rhetorical utterances, but grave matters of fact, which the gas industry would do well to make a note of. Be it observed that this inquiry is confined, at present, to statutory gas undertakings in the United Kingdom, other than those of local authorities. The corporation works, being on a different footing, are not taken; but should health and inclination hold, the writer hopes to be in a position to deal with that important class of works later.

When dealing with the national gas supply concretely or as a whole, it is easy to affirm that some 8 or 9 per cent. is "unaccounted for," and there at an end. But this conveys a very meagre notion or faint idea of the enormous loss being sustained by this chronic system of waste. We gain little knowledge or information by such a cursory method of examination. Abstractedly considered, however, we arrive at results as widely divergent as they are astonishing. On these lines, therefore, let us apply, without bias, and with judicial calmness, the cubic foot measure to this mystic phraseology "unaccounted for gas," and endeavour to become better acquainted with this innocent looking idiom. Omitting one or two works that profess to sell more gas than they make (which is honestly impossible), and disregarding a similar number whose returns are unintelligible, no less than 438 towns furnish data which are assumed to be correct, and on which these calculations are based. The works are classified in eight groups, according to their carbonizing capacity, to which a distinguishing letter is prefixed. (See table.) Thus, the works comprised in "A" are of the smallest size, none using 1000 tons per annum; "B," 1000 to 2000 tons; "C," under 4000; similarly, "D," under 6000; "E," under 9000; "F," not exceeding 20,000; "G," not exceeding 60,000; and "H," all works using above that quantity.

It therefore appears that the ratio of unaccounted-for gas in 32 towns is less than 5 per cent., in 44 it is between 5 and 7 per cent., in 93 between 7 and 10 per cent., in 175 between 10 and 20 per cent., in 59 between 20 and 30 per cent., in 20 between 30 and 40 per cent., and in 15 works it exceeds 40 per cent. leakage. Or, to express it another way, we find that column No. 1 gives this result—*i.e.*, 7·307 per cent. of the total works taken account for all their gas, *plus* 5 per cent.—that is to say, none exceed 5 per cent. As a matter of fact, some are under 3 per cent. The works in column No. 2 constitute rather over 10 per cent. of the whole, and are well under 7 per cent. of "unaccounted-for gas." Column No. 3 contains over 21 per cent. of the total number of works with less than 10 per cent. of leakage. Column No. 4, which comprises (say) 40 per cent. of the whole number, absorb from 10 to 20 per cent.; column No. 5, which contains 13·47 per cent. of the works, engross between 20 and 30 per cent.; column No. 6, which contains more than 4·56 per cent. of the towns, swallows between 40 per cent.; and lastly, column No. 7, which contains nearly 3·5 per cent., engulphs over 40 per cent. Now it is patent that both large and small works can be, and are, managed with a loss of gas under 5 per cent., as shown by column No. 1. The condition of the others, therefore, excepting those appearing in column No. 2, must be considered unsound, bad, if not indefensible.

Accidents to mains and pipes by subsidence and unexpected and serious contingencies may account for much; but such an enormous volume of purified gas to escape between the holders and the consumers' meters is the reverse of creditable to the gas industry, and calls for prompt attention with a view to a permanent remedy until the euphemistic idiom "unaccounted-for gas" ceases to be a reproach. Had, in times past, equal skill and ability been shared between carbonizing coal and distributing the gas, it is unlikely that leakage would have grown to its present huge proportions. That it should really be reduced to a minimum goes without saying. What should be the minimum is not so easy to decide. Local circumstances should be fairly considered, and a distinction drawn between flat and rural towns where disturbing causes seldom operate to the detriment of gas-pipes, and places situate in the salt districts where the operation of pumping brine from the mines is a fruitful and constant source of surface motion, serious subsidence, and consequent damage to underground pipes. In such districts, levels and gradients are almost unknown. Buildings sink several feet in a day; and to conduct gas distribution on correct principles and with economy in such topsy-turvy localities as this demands the highest skill, and most exemplary patience. But many of the works shown in the table, whose waste of gas is undeniable, are not afflicted with salt, coal, or any such disturbances. More than one is found in possession of an ideal district, and yet persists in the perpetuation of a reprehensible system of waste. In very large undertakings, we find an officer directly called the "Distributing Engineer" responsible to his chief for leakage. The appointment of such an official in medium-sized works might be made with advantage. His functions would embrace and insure the reduction of "unaccounted-for gas" to such insignificant proportions as to escape censure, deserve commendation, and thus advance the material, financial, and moral status of the gas industry and all connected therewith and belonging thereto.

In the compilation of the following table, works are not named for reasons that are obvious; and the author ventures to hope that the omission will be appreciated by those Companies who are weighed in the balance and found wanting in this matter of "unaccounted-for" gas.

TABLE *Showing the Percentage of "Unaccounted-for Gas" in 438 Undertakings in the United Kingdom, in Groups.*

Groups.	Coal Used per Works per Annum Under.	Towns Under 5 per Cent.	Towns Under 7 per Cent.	Towns Under 10 per Cent.	Towns Under 20 per Cent.	Towns Under 30 per Cent.	Towns Under 40 per Cent.	Towns Over 40 per Cent.	Aggregate of the Towns.
	Tons.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	
A	1,000	2	5	2	21	16	6	6	58
B	2,000	2	6	12	33	13	10	4	80
C	4,000	3	2	22	41	11	3	2	84
D	6,000	6	6	14	21	5	..	2	54
E	9,000	5	4	8	20	9	..	1	47
F	20,000	6	7	11	24	2	1	..	51
G	60,000	5	10	16	14	..	..	..	45
H	100,000 and upwards	3	4	8	1	3	..	..	19
	Totals . .	32	44	93	175	59	20	15	438

Manurial Trials with Sulphate of Ammonia.—According to experiments, which have lasted over three years, carried out by M. Gerlach, nitrate of soda is superior to sulphate of ammonia for winter corn only as a top dressing. If the sulphate is applied a few weeks earlier, it acts much more favourably than nitrate. Experiments by Klöpfer on potatoes and sugar beet showed that very heavy dressings of sulphate acted very favourably when the ground was carefully worked and the seed selected; and that there was no reason for preference being given to nitrate. Further experiments by him showed that in the following year oats cultivated as an after-crop derived very considerable benefit from the nitrogen which had remained in the soil from the previous trials. The ammoniacal nitrogen was therefore, like the nitrogen of stable manure, not lost as in the case of nitrate nitrogen, when rain set in, or the crop had not entirely exhausted the dressing.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting at Bradford.

The early winter weather this year—bringing in its train added responsibilities to the gas manager, and in some few cases temporary indisposition—accounts for the fact that the attendance of members at the one hundred and thirty-second meeting of the above-named Association was not quite up to the average of recent similar gatherings. However, a goodly representation from all parts of the extensive district met at Bradford, and were amply rewarded by an interesting day's proceedings—under the direction of the President, Mr. Arthur Graham, of Mansfield.

An hour and a half in the morning was usefully occupied with a visit to the new Central Fire Station in Nelson Street. By direction of Mr. Councillor Freeman, the Chairman of the Fire Brigade Committee of the Corporation, the whole of the vast establishment was thrown open to the inspection of members; and Mr. James Scott, the Chief Officer of the Brigade, and several of the assistants, proved efficient guides through the various departments to which they are severally assigned. A "fire call" was arranged and smartly responded to; the horsing of the engines, and the starting of a couple of fully-equipped steamers, being accomplished well under a minute from the sounding of the fire-bell. One of the features that perhaps appealed more than anything else to the engineers among Saturday's visitors was the fire-alarm office and its arrangements for receiving calls from the 78 signal-boxes fitted throughout the town, recording same, and giving immediate notice to all the six district engine-houses as to the locality of the outbreak. Probably there is not in England any more complete and up-to-date arrangement of electrical plant for this particular purpose.

Ample time was at disposal after the visit and before the luncheon that had been arranged for 1.30 p.m. to precede the business meeting at the Midland Hotel at 3 o'clock. The President confined the toast-list to "The King" and "The Visitors;" the latter being responded to by Mr. R. Thornton, the Chairman of the Longwood Gas Company. Three hours were occupied in the ordinary business of the Institution; and at its close high-tea was served, and the party broke up at 7.30—well satisfied, all of them, at the eminently useful and interesting character of the whole proceedings.

The Business Meeting.

The Hon. Secretary (Mr. R. G. Shadbolt, of Grantham) read the minutes of the previous meeting, which were confirmed.

Scrutineers of the balloting papers were then appointed, and the reading and discussion of papers was proceeded with. The papers will be found in another part of the "Journal;" but, owing to a failure in the postal service yesterday (which is quite inexplicable), we are unfortunately compelled to hold over till next week the report of the discussion upon them.

On the resumption of the general business,

The President moved a resolution to the effect that the travelling expenses of the new Hon. Secretary should be paid out of the funds of the Institution; and the resolution was carried.

The following are the officers for the ensuing year:—

President.—Mr. S. R. Ogden, of Blackburn.
Vice-Presidents.—Mr. J. H. Brearley, of Longwood, and Mr. S. Meunier, of Stockport.
Secretary.—Mr. H. Kendrick, of Stretford.
Honorary Treasurer.—Mr. Thomas Newbigging, of Manchester.
Auditors.—Mr. E. Lord, of Whitworth, and Mr. G. W. Lupton, of Otley.

Mr. W. W. Hutchinson proposed a vote of thanks to the readers of the papers. He said the papers which had been read were appropriate to the present time, and appeared to have been prepared with very great care. They were placed before the meeting in such a way as to facilitate discussion upon them; and in this connection he might say he felt convinced that, had time permitted, there would have been a longer debate.

Mr. Meunier seconded the motion. He said the papers had been very interesting. Mr. Brearley's paper especially had indicated a new departure; while Mr. Buckley's had laid before them a valuable experience of what was undoubtedly a very difficult case to deal with.

The motion having been carried,

Mr. Brearley and Mr. Buckley returned thanks.

Mr. S. S. Mellor proposed a vote of thanks to the Chairman of the Fire Brigade Committee and Superintendent Scott for their courtesy that morning at the Fire Station.

Mr. Shadbolt seconded the motion; adding that he thought Mr. Wood's name ought to be coupled with the others, as he had been indefatigable in making the meeting a success.

The motion was put and carried.

Mr. Wood returned thanks on behalf of the Chairman of the Fire Brigade Committee, who, he said, was prevented from being present owing to an important engagement.

The proceedings then closed.

THE LIGHTING OF FACTORIES.

By J. H. Brearley, of Longwood.

[A Paper read before the Manchester District Institution of Gas Engineers, Dec. 6.]

It is now over a century since the first attempt to light a factory with coal gas was made; for it is recorded that in 1798 Mr. William Murdoch fitted up a portion of the works of Messrs. Boulton and Watt, at Soho, Birmingham, with what was then a new and sensational illuminant. With the multiplication of factories that has taken place since then, the problem of satisfactorily lighting them is of infinitely vaster importance in 1902 than even Murdoch in his most optimistic moments could have anticipated. If some occult power would but bring him among us now, we may venture to think that he would not be ashamed of the handiwork of his disciples; for truly never since then has a difficulty faced the industry to which he gave birth, but some indomitable spirit has evolved the means to surmount it, not even excepting the competition with electricity in the lighting of factories.

As you are all aware, gas until the later eighties held practically undisputed sway. But then competition became very real, and many factories adopted the new light. There was much sounding of the loud timbrel; the days of gas lighting were said to be numbered; and for a time pessimism darkened the horizon. It is a matter of history how its prestige has been maintained; and the object of this paper is to show, if possible, in itself and the subsequent discussion, that not only can gas lighting maintain the ground which it now holds in the sphere of factory lighting, but may with reason hope to wrest from its energetic rival some of the ground that has been lost.

It has been said in the presence of the writer that factory consumption was not worth having—that it comes on us when the days are short, and bid adieu when the days are longer, leaving the plant provided for it practically idle for seven or eight months in the year. Be that as it may, there are few of us, being human, but have heaved a sigh of regret when first one big cheque and then another has ceased to give us a call on its way to the bankers. In some districts the loss of these old friends has been well-nigh disastrous. In manufacturing centres, the competition of public electric supply is as nothing compared to that which comes from private electrical installations.

It needs no demonstration—the fact being too well known—that a manufacturer, or indeed anyone else, can seldom obtain energy from a public supply upon terms favourable enough to compete with even flat-flame gas-lighting. Millowners, however, claim that, by generating their own energy, they can effect a saving, though this comparison is almost invariably taken as against flat-flame lighting. Now that the utility of incandescent fittings for factories has become an established fact, it is necessary that millowners should be disabused of this idea; for, except in very exceptional cases, electric lighting will not bear comparison with incandescent gas. Where electricity is installed, and the driving plant is overtaxed, the cheapest and most satisfactory way to better things is by the substitution of incandescent burners with suitable anti-vibrators.

Once a factory owner becomes his own lighting engineer, it requires, perhaps, a strong effort of self-abnegation to once again sacrifice self-control of the source of light; but if it is cheaper and better, he can do many a worse thing. He will find in the composite gas engineer of to-day, with the experience of a century behind him, a man who can be relied upon to give the best advice upon lighting matters. If electricity is better for a certain purpose than gas, he is usually candid and says so.

It has been put forth as a great claim for electric lighting that the rooms are much cooler than with gas. As against flat-flame burners, this undoubtedly is the case; but in every instance where the writer has put the question to those who had substituted incandescent for flat-flame burners, "What is the effect of the incandescent burners on the atmosphere of the rooms?" he was met with this or a similar reply: "So far as I can see, the atmosphere is perfect; different altogether from the conditions that previously prevailed." The small amount of heat that arises from the use of incandescent burners is not considered a disadvantage. Upon this head it may be remarked—though most of you are probably aware of the fact—that heat is essential in a cotton mill, and it is found an advantage in a woollen mill, for the material will work better in a warm atmosphere. Then, again, the hours of lighting are those when the temperature is coolest. The operatives, particularly in spinning and similar processes, cannot perform their duties satisfactorily with cold hands—the fingers must be pliable.

The woollen industry being the staple trade of the Huddersfield district, the observations of the writer were mostly confined to mills devoted to this branch of trade. Where incandescents were used, the number varied from one-half to one-third of the previous flat-flames, though in some cases one incandescent replaced four ordinary burners. Lighting a factory is a totally different thing from lighting a large hall or church; the respective processes carried on, and the machines used, deciding where and how many burners shall be employed. In spinning, weaving, and similar work, an even distribution of light is essential.

In woollen weaving, the practice abounded of having flat-flames with a swivel joint, so that the bracket could be moved by the weaver to any given point. Three brackets and burners were used for each loom; but with incandescent burners, a number of looms were beautifully lit with one burner each without the necessity for a movable device. The writer subsequently saw looms, each of which had for lighting three 16-candle electric lamps, and the comparison certainly did not flatter the latter.

When fixing incandescent lights in a factory, careful thought should be given to the position, both with respect to distribution of light and liability to breakages. Take, for example, spinning mules. It is much preferable to fix the lights down the centre, or "mule-gate" as it is termed—say, 7 feet from the floor-line—than over the "creel" or bobbins, which are constantly being changed. The breakages in the latter case would probably be four times the former with the same number of lights.

For the purpose of making a comparison between gas and electricity, a specification has been prepared (Table 1.) of an average woollen mill. The number of lamps required respectively are taken from actual practice in the Huddersfield district.

It may seem strange to gas engineers that so many incandescent burners should be required to replace the electric lamps; but a good distribution of light, as already stated, is essential in most processes—in the spinning of black material, for instance. A comparison of the candle power, however, is obviously in favour of the incandescent system. Thus—

369 16-candle electric lamps . . .	=	5,904	candle power
157 "C" burners at 70 candles each.	=	10,990	,,
Increase from use of "C" burners .		5,086	,, or 86 per cent

The cost of providing this mill with its electric lighting would be £387 (Schedule A). The cost of fitting up with incandescent "C" burners and anti-vibrators, including all piping and fittings beyond the meter, would be £108 (Schedule B). Schedule C shows the number of hours that artificial light would be required when working—

(*a*) From 6 a.m. to 6 p.m.
(*b*) From 6 a.m. to 9 p.m.
(*c*) Throughout the twenty-four hours from 6 a.m. on Monday morning to twelve noon on Saturdays.

In compiling the figures of lighting hours, it is presumed that the mills are closed from Saturday noon to Monday morning. It will be understood that an approximate estimate only can be made, as the liability or otherwise to heavy fogs, the situation of the mill, &c., will affect the number of hours of lighting. Even the difference of lighting between the top and bottom rooms is often appreciable. Still, taking the three methods of working (as per schedule), we get a fair basis for comparison; and any variation from the figures given will affect in the same direction both the electric and incandescent gas installation.

From the schedule, it will be seen that the lighting hours per annum are as follows, holidays being ignored:—

From 6 a.m. to 6 p.m.	368 hours.
,, 6 a.m. to 9 p.m.	891 ,,
Full day and night	3,073 ,,

Tables II. and III. give the working account of electricity and gas respectively.

The 369 16-candle lamps, consuming energy at the rate of 60 Watts each, will use 22·14 units per hour. The 157 "C" burners, consuming gas at the rate of 4 cubic feet per hour, will use 628 cubic feet per hour. From these two factors, in conjunction with the lighting table, we get the units used and gas consumed per annum. The life of the electric lamp varies considerably with the change in pressure; but if a 110-volt lamp is kept at 110 volts pressure, it will last about 1000 hours, though during this time there is a gradual diminution in the light given off. This may be taken as a set-off against the diminution in light given by the incandescent mantle. The renewals in electric lamps are calculated at 1000 hours' life.

The renewals of incandescent mantles for factory use is more difficult to get at, because few millowners as yet keep accurate records of mantle renewals. One manufacturer, who worked throughout last winter until 8 p.m., gave me figures which worked out to 0·4 mantle and 0·3 chimney per burner. While this is a remarkably low record, there is no reason why, with ordinary care, it should not be equalled by almost any department of a woollen mill. Another manufacturer, while not keeping a record, said that he had some mantles in use at the present time, giving an excellent light, and the same mantles were used throughout last winter. He added a condemnation, however, of cheap mantles; and after a trial of these, he had reverted to Welsbachs. The figures taken for renewals, as per Table III., will be, if anything, above the average.

The remaining columns of Tables II. and III. show: (*a*) The cost of maintaining electric installation, including interest on outlay, but *minus* cost of current. (*b*) The cost of maintaining the incandescent system, including interest on outlay, and *plus* cost of gas. The cost of mantles and chimneys has been taken at 4d. each. From these figures, it will be noted that a factory owner, working only the ordinary day hours from 6 a.m. to 6 p.m., will pay for interest and maintenance of electric installation, without current, £63 14s. 4d. per annum; while the incandescent installation, including gas, will cost him £50 19s. 5d., or £12 14s. 11d. less.

A mill working from 6 a.m. to 9 p.m. will cost for electric fittings and maintenance, without current, £71 15s. 2d. per annum; while an incandescent gas installation, including gas, will cost £95 18s. 9d., or only £24 3s. 7d. more. Put another way, the electric plant must produce the 19,727 units required at a cost of 0·29d. per unit to compete with the gas installation. This, it must be remembered, is notwithstanding that the gas installation gives 86 per cent. more light. If the same amount of light had to be generated by the electric plant, the cost per unit must only be 0·16d.

A mill working all day and night from Monday morning to Saturday noon throughout the year will cost for interest on electric fittings and maintenance, without current, £105 6s.; while the gas installation, including gas at 2s. 6d. per 1000 cubic feet, will cost £273 2s. 6d., leaving a difference of £167 16s. 6d. to pay for the current. The 68,036 units, therefore, must be produced for 0·59d. per unit. And let it be emphasized again that even with the gas installation there is 86 per cent. more light. The number of units required for equal light would be 126,546, which should cost not more than 0·32d. per unit. Moreover, nothing is charged for the supervision of the electric installation, though this will be considerably greater than the attention required by the incandescent burners. Neither is it debited with a portion of the cost of the motive-power plant; it being assumed that the factory has the surplus power necessary for driving the dynamo.

The argument is frequently met with that if a millowner has surplus power, the additional cost of running a dynamo is scarcely noticed; but those millowners who have taken the trouble to keep a record of the fuel account with and without a dynamo know better. Power must be provided, or must be already available at the rate of 1 indicated horse power for ten 16-candle lamps; and it is patent that a factory of the size we have taken, requiring 369 16-candle lamps, or an extra power of of 37 indicated horse, must have a considerable increase in its fuel account.

The liability to breakdown of electric plants is not a negligible factor when comparing the two lights. It is not an unknown occurrence for the electric current to be instantly shut off a factory while all the machinery is running. The breaking of a strap or some other small matter, trifling in itself, is sufficient to cause grave risk of accident, and dislocation of manufacturing operations. These things have a knack of happening when a factory is at its busiest, and when stoppages can be least afforded. Losses sustained thereby cannot be easily reduced to £ *s. d.*

The number of incandescent lights required for a cotton mill will not be as many as for a woollen mill, taking equal floor-area; for the materials operated upon are lighter in shade, and the machines are not so high.

It will be noted that the comparison in the tables is with the ordinary "C" burner. The writer has not been able to satisfy himself yet that the intensified 10-feet burners are suitable for this class of lighting; though if they can be made suitable, they would undoubtedly result in a still more favourable comparison for the use of gas as against electric light. The same amount—indeed, rather more light—would be provided in each room by the use of seven 10 feet high-pressure gas-burners, or a total of 42 burners for the six rooms. Thus: 42 × 300-candle power each = 12,600-candle power.

The cost of this installation complete would be about £210; this amount including all piping and fittings beyond the meter. The mantle renewals at the present price would be 10d. each. But there would be fewer burners to maintain; and even if each burner took four mantles per annum, the total cost of renewals would not be more than £7. The gas consumption per hour would be 420 cubic feet, as against 660 cubic feet by the "C" burners, or a saving in gas of 33 per cent. When the high-pressure lamps have been demonstrated as suitable for low rooms densely packed with machinery, the figures may be further compared with "C" burners and electric lamps on the basis laid down in Tables II. and III.

The superiority of high-pressure gas lighting, however, for sheds, tool and machine works, and almost any lofty rooms has been fully proved by practice. A week or two ago, by the courtesy of the firm, I was conducted through the extensive workshops of Messrs. Harding, Richardson, and Rhodes, Tower Works, Leeds, and received useful information as to the comparative advantages of gas and electricity in use there. There are two kinds of high-pressure gas lighting, and also arc electric lamps deriving energy from the firm's own dynamo. It is found that while the cost of arc lighting in the workshops is rather less than high-pressure gas lighting, the latter gives a superior lighting effect. The arc lamps throw shadows which the employees find a disadvantage; the class of work being of a delicate kind. This difficulty is not experienced with high-pressure gas-lamps; and for this reason they are preferred.

One workshop was lit with 34 high-pressure lamps with large reflectors, but no covering globe for the mantles; and each lamp consisted of two 10 feet high-pressure burners. (The shed is full of machinery used in the preparation of steel cylindrical combs for various textile machines.) There is thus a consumption of 680 cubic feet per hour, or 1 cubic foot per 12·5 square feet of floor area per hour. Some of the machines, however, had small electric lamps fitted close to the delicate work carried on; but for ordinary work, the lighting was, without these, everything that could be desired. The increase in pressure was obtained by water power, The renewal of mantles averaged one per burner

for 14 weeks; the position in which the lamps are fixed being an important factor in the life of the mantles. Some that had been put on over a year ago were still in use; but these were free from the influence of draughts, &c. All the walls were of white glazed brick, showing a practical appreciation of the value of reflected light.

Insurance of Factories.

It would be presumptuous on the part of the writer to attempt to teach insurance companies their business. We all know from experience that they understand that pretty well, and probably have a perfectly logical reason for the rates that are levied upon the various classes of lighting. When we learn that electric lighting causes more fires proportionately—than flat-flame gas-lighting, we are grateful that the rate for insuring gas-lit premises is not greater than for electrically-lit premises (corn mills excepted). It is difficult to comprehend, however, why incandescent lighting—which in many cases causes a large decrease in the number of burners—should result in some cases in an increase in the rates. Probably as yet the insurance companies have not sufficient data to work upon in the compilation of rates, and prefer to err upon the side of discretion. If, however, flat-flame lighting is about equal to electric lighting in point of risk, then, with the large reduction in the number of burners which usually ensues from the adoption of incandescents, we may reasonably expect a lower rate for this class as against electric lighting, when the insurance companies have had a more extended experience of it. At present, however, we labour under the disadvantage of having the rate actually raised in some departments. Through the courtesy of the insurance offices, the writer is able to give particulars as to the effect of incandescent gas lighting upon rates of insurance as follows:—

Extract from Letter to Insurance Offices, *re* Factory Lighting.

Do you increase the rate per cent. when incandescent gas lighting replaces flat-flame lighting; and if so, how much?

Do you increase the rate per cent. when incandescent gas lighting replaces electric lighting; and if so, how much?

If you have differential rates according to the class of manufacture, kindly give particulars.

Synopsis of Replies.

Woollen Mills.

If approved incandescent gas-lamps are used in processes in raw fibre—that is, in rooms wholly or partly occupied for the purpose of shaking, rag grinding, willeying, burring, garnetting, carding, or dry raising—3s. per cent. extra.

If incandescent gas-lamps other than approved incandescent gas-lamps be used—5s. per cent. extra.

If approved incandescent gas-lamps be used in buildings used for weaving, stockinette knitting, twisting, doubling, warping, warp dressing, beaming, winding, reeling, cloth drying on steam cylinders, ballooning—no extra rate.

If incandescent gas-lamps other than approved incandescent gas-lamps be used therein—5s. per cent. extra.

Cotton Mills.

Approved incandescent gas-lamps—no extra rate. Unapproved gas-lamps—5s. per cent. extra.

Worsted Mills.

If approved incandescent gas-lights be used in processes in raw fibre—that is, in rooms wholly or partly occupied for the purpose of burring, garnetting, willeying, or carding—2s. per cent. extra. Unapproved gas-lamps—5s. per cent. extra.

Hosiery and lace factories, woollen spinning mills and sheds, woollen weaving mills and sheds, worsted spinning mills, worsted weaving mills and sheds, and cotton and flax mills: Approved incandescents—no extra rate; unapproved ditto—5s. extra.

Description of Approved Lamp.

An approved incandescent gas-lamp is one wholly constructed of metal, glass, or other incombustible material; the said lamp is to be connected with the gas supply by a metal pipe, which, if flexible, shall be of not more than 18 inches in length. The pipe, whether flexible or not, shall be securely attached to the gas-lamp and supply-pipe respectively by proper screw connections, or by being soldered or brazed thereto. Bye-passes or pilot lights are not allowed.

Note.—There is no reduction in rate in any of the above classes of factories for electric lighting in woollen or worsted mills. If the lighting were to be done by unapproved arc lamps, it would add 1s. per cent. to the rate charged.

It is to be hoped that there will soon be a revision of these rates so that incandescent gas-lighting, which is bound to flourish as an illuminant in factories, will not be retarded by a different rate for insurance. It would come as a revelation to most of us to learn positively that the risk was greater with these than with ordinary open flat-flame burners.

In reporting upon the means of ventilation in factories and workshops, Dr. J. S. Haldane, F.R.S., and Mr. E. H. Osborne, Engineering Adviser to the Chief Inspector of Factories, said: "The much more general use of incandescent mantles in factories and workshops is very desirable, with a view to avoiding excessive vitiation of the air, and at the same time obtaining a good

Table I.—*Woollen Mill, 138 Feet Long 45 Feet Wide, and Six Storeys High.*

PARTICULARS OF PROCESSES AND LIGHTS REQUIRED.

Col. A, Process; Col. B, 16-Candle Electric Lamps; Col. C, Incandescent "C" Burners.

Ground Floor.			First Floor.			Second Floor.			Third Floor.			Fourth Floor.			Fifth Floor.		
A.	B.	C.	A.	B.	C.	A.	B.	C.	A.	B.	C.	A	B.	C.	A.	B.	C.
Finishing . .	8	3	Four sets	..	..	Four sets	..	..	Four sets	..	..	44			16 looms	40	16
Milling . . .	6	2	of scribb-	..	..	of scribb-	..	..	of scribb-	..	..	looms	110	44	4 warping		
Teazing . . .	4	1	ling and	..	..	ling and	..	.	ling and	..	..				machines	16	6
Wool-scouring }	4	2	carding	..	..	carding	..	..	carding	..	..				winding		
Dyeing }			machines	9	6	machines	9	6	machines	9	6				and heald- }		
Engine-room .	3	1	and four	..	..	and four	..	..	and four	..	..				ing, 5 }	38	10
Stoke-hole . .	1	1	spinning	..	..	spinning	..	..	spinning	..	..				twisting }		
Stove-room . .	2	1	mules	32	14	mules	32	14	mules	32	14				frames, 500 }		
Offices . . .	6	2													spindles		
Staircase . .	6	6															
Yard Lamps .	2	2															
Totals . .	42	21	..	41	20	..	41	20	..	41	20	..	110	44	..	94	32

Summary of Lights.

369 16-candle electric lamps = 5,904-candle power, proportion 100
157 incandescent "C" burners = 10,990 ,, ,, 186

Table II.—*Working Statement, Electric Lighting. Cost of Installation, £387.* (*See* Schedule A.)

Hours of Work.	Lighting Hours per Annum (see Schedule).	Number of 16-Candle Lamps.	Units Used per Hour.	Units Used per Annum.	Lamp Renewals.	Interest and Maintenance at 15 per Cent. on Cost of Installation.	Add Lamp Renewals at 10d.	Total Maintenance.
						£ s. d.	£ s. d.	£ s. d.
6 a.m. to 6 p.m.	368	369	22·14	8,147	136	58 1 0	5 13 4	63 14 4
6 ,, ,, 9 ,,	891	369	22·14	19,727	329	58 1 0	13 14 2	71 15 2
All day and night	3073	369	22·14	68,036	1134	58 1 0	47 5 0	105 6 0

Table III.—*Working Statement, Incandescent Gas Lighting. Cost of Installation, £108.* (*See* Schedule B.)

Hours of Work.	Lighting Hours per Annum (see Schedule).	No. of "C" Burners.	Cubic Feet used per Hour.	Cubic Feet used per Annum.	Mantle Renewals per Burner per Annum.	Total Mantles per Annum.	Chimney Renewals per Burner per Annum.	Total Chimneys per Annum.	Interest and Maintenance, 15 per cent. on Cost of Installation.	Add Renewals of Mantles and Chimneys at 4d.	Add Cost of Gas at 2s. 6d. per 1000 Cubic Feet.	Total Cost per Annum, Including Gas.
									£ s. d.	£ s. d.	£ s. d.	£ s. d.
6 a.m. to 6 p.m.	368	157	628	231,100	1·5	235	0·75	118	16 4 0	5 17 8	28 17 9	50 19 5
6 ,, ,, 9 ,,	891	157	628	559,500	2·5	392	1·25	196	16 4 0	9 16 0	69 18 9	98 18 9
All day and night	3073	157	628	1,929,800	4·0	628	2·00	314	16 4 0	15 14 0	241 4 6	273 2 6

and perfectly steady light." If the percentage of carbonic acid in the air of factories and workshops becomes the subject of legislation, this will add an additional reason why factories now using flat-flame burners should be lit with incandescent gas-burners. Meanwhile those manufacturers who are already doing this can view that possible contingency with equanimity.

SCHEDULE A.

Cost of Electric Installation for Woollen Mill, 138 Feet Long, 45 Feet Wide, and Six Storeys High.

IN ENGINE-ROOM.

One dynamo, compound-wound, and mounted on four slide rails, the dynamo to have an output of 220 amperes at a potential of 110 volts when running at a speed of 580 revolutions per minute, and capable of supplying 400 lamps of 16-candle power; the armature to be of the drum-bar type, and to be supported on three self-oiling bearings	£135	0	0
Foundations, &c.	10	0	0
One 9½-inch belt	12	0	0
One switchboard, consisting of two enamelled slate panels on which is mounted one fancy bracket with lamp and switch, one voltmeter, six double-pole fuses, six single-pole circuit switches (one to control each room), one double-pole main switch, one shunt-regulating switch, with 16 contacts; the metal work to be highly finished and lacquered, and the switchboard to be enclosed in a polished teak frame	18	0	0

WIRING.

Cost of wiring 369 lights complete with lamps, switches, and shades, at 11s. 6d. per point	212	3	6
	£387	3	6

SCHEDULE B.

Cost of Installation of Incandescent Gas Lighting.

157 "C" burners, with anti-vibration frames fixed complete, at 11s. each				£86	7	0
60 feet of 1½-inch tubing, at 15d.	£3	15	0			
152 ,, 1 ,, ,, 8½d.	5	6	3			
180 ,, ¾ ,, ,, 6d.	4	10	0			
180 ,, ½ ,, ,, 4½d.	3	7	6			
688 ,, ¼ ,, ,, 3d.	8	12	0			
Total	£25	10	9			
Less 65 per cent.	16	11	9			
	£8	19	0			
Add 25 per cent. for connections, &c.	2	4	9			
Add labour, at 6d. per yard	10	10	0			
				21	13	9
				£108	0	9
				Say £108	0	0

SCHEDULE C.

Month.	6 a.m. to 6 p.m.	6 a.m. to 9 p.m.	Full Day and Night to Saturday Noon.
January	88	154	354
February	32	92	272
March	2	64	259
April	..	37	204
May	..	17	150
June	..	..	120
July	..	5	133
August	..	25	178
September	..	55	238
October	41	107	307
November	88	152	409
December	117	183	449
Totals	368	891	3073

EXPERIENCES OF INCANDESCENT STREET LIGHTING AT FORMBY.

By J. H. BUCKLEY, of Formby.

[A Paper Read before the Manchester District Institution of Gas Engineers, Dec. 6.]

Formby is situate between Liverpool and Southport—twelve miles from the former, and six miles from the latter; and though the district has been supplied with gas since the year 1879, it was not until 1898 that street lighting was paid for directly out of the rates. It will be quite understood, therefore, that only a few lamps were in use up to this time, owing to the cost having to be defrayed voluntarily by persons who desired light near their premises. Many attempts had been made to induce the ratepayers to adopt street lighting; but it was not until the year above mentioned, when we were threatened with the introduction of electricity, that they decided to do so. Consequently, a determined move had to be made on behalf of the Formby Gas Company, through the local Press, and by fixing an incandescent "C" burner in a lamp near to where the Council met. By adopting these means, we were enabled to demonstrate that gas would be by far the cheapest lighting medium. However, the Council—as local authorities usually do—obtained estimates for both gas and electricity; and after fully considering the question, they finally decided on the adoption of Mr. C. R. Bellamy's patent lamp, owing to the small maintenance charge found by practical experience at Liverpool—viz.,

Mantles, average annual renewals	2·6
Chimneys ,, ,, ,,	2·3
Mantle rods ,, ,, ,,	0·23

The Council decided to erect 100 of these lamps, upon the following conditions—viz.: (1) The Local Authority provided all columns, lamps, burners, &c., and fixed them; the Formby Gas Company supplying all pipes and fitting from the main to the tap, and charging for all material and labour from the base of the lamp upwards. (2) All gas to be supplied on the average meter system—one meter for every 25 lamps—and each burner to be provided with a well-constructed regulator. (3) The Local Authority advertised for lighting, cleaning, extinguishing, and general maintenance; and they accepted the tender of a local gas-fitter at £3 per week inclusive.

This arrangement was anything but satisfactory, as frequently lamps requiring repairs—mantles, chimneys, rods, &c.—were left several days without attention and unlightable; so that a strict watch had to be kept on lamps where meters were attached, and particulars noted in order to charge for the quantity consumed by the other lamps. Taps were found on many occasions partially turned off; and lamps were frequently discovered alight in the mornings which should have been extinguished at 12 o'clock the previous evening. Consequently, after 18 months' dissatisfaction, the Council decided to make a change—in fact, they had gone so far as to appoint a fitter of their own, and employ their own lamplighters. As soon as the writer became aware of this, he considered it an opportune time to get the whole into his own hands; and with the permission of his Directors, he approached the Council for that purpose. After learning their requirements, he quoted them an inclusive price, which they accepted; and so satisfied were they with the change, that the Company are now almost half through a third contract.

There are now 135 lamps in the writer's district, and are fixed at distances varying from 10 yards to 450 yards apart, lamp to lamp—the whole covering a distance of about ten miles; and as the Local Authority compel all the lamps to be lighted within one hour of sunset, four lamplighters are necessary. When the writer took over the lamps, in order to get a daily report of the condition of the mantles, &c., he introduced a lamplighter's report card. Each lighter obtains a card every evening before proceeding on his round, and brings it in next morning, when it is handed to a thoroughly qualified fitter. After the latter has executed the repairs (if any are required), he enters all materials, &c., against each lamp in a "record book;" and at the end of the lighting contract, the renewals account is balanced to ascertain the financial result. The attached is a copy of the report card; and underneath is the heading of the "record book" referred to.

FORMBY GAS COMPANY, LTD.

LAMP LIGHTERS' REPORT.

Round No. _____

Lighter _____

No. of Lamps on Round _____

LIGHTING.

TIME.		
Started.	*Finished.*	*No. of Lamps Lighted.*

EXTINGUISHING.

TIME.		
Started.	*Finished.*	*No. of Lamps Extinguished.*

Remarks.

"RECORD BOOK" HEADING.

Date of Repairs.	Lamp No.	Mantles.	Rods.	Chimneys.	Springs.	Glass.	Sundry Goods.

In quoting an inclusive price, it was estimated that £1 1s. would be required to cover mantles, rods, chimneys, bulbs, springs, rubbers, and glass, and men's time repairing, lighting, extinguishing, and cleaning. It will be seen, from the figures in the table, that a slight loss was the result of the first contract, and a profit on the second.

First Year's Contract.

Dr.	£	s.	d.	Cr.	£	s.	d.
To 871 Mantles	18	2	11	By amount received for maintenance—			
,, 189 Chimneys & bulbs	3	7	4	,, 123 Lamps, 1st half year	64	11	6
,, 48 Rods	0	2	0	,, 125 Lamps, 2nd half year	65	12	6
,, 112 Springs	0	4	8	,, Balance, loss	0	10	9
,, 25 Rubbers	0	4	5				
,, Glass	2	14	6				
,, Time repairing, &c.	23	5	0				
,, ,, lighting, &c.	82	13	11				
	£130	14	9		£130	14	9

The above contract was for ten months—Aug. 1, 1900, to May 31, 1901; and the lamps were not lighted for eight nights in each month during the period of moonlight.

Second Year's Contract.

Dr.	£	s.	d.	Cr.	£	s.	d.
To 791 Mantles	16	9	7	By amount received for maintenance—			
,, 232 Chimneys & bulbs	4	5	1	,, 129 Lamps, 1st half year	67	14	6
,, 93 Rods	0	3	10½	,, 129 Lamps, 2nd half year	67	14	6
,, 260 Springs	0	10	10				
,, 23 Rubbers	0	4	1				
,, Glass	1	1	0				
,, Time repairing, &c.	20	16	6				
,, ,, lighting, &c.	73	7	1				
,, Balance, profit	18	10	11½				
	£135	9	0		£135	9	0

This second contract differs from the first; it being for eight months—Sept. 1, 1901, to April 30, 1902—with non-lighting during the moon as follows: September, 8 days; October, 7 days; November, 4 days; December, 4 days; January, 4 days; February, 4 days; March, 7 days; April, 8 days.

The average renewals per burner work out as follows:—

	First Contract.		Second Contract.
Mantles	6·96	..	6·08
Chimneys	1·51	..	1·80
Rods	0·39	..	0·71

The writer is fully aware of the high average renewals compared with many other districts; and he is inclined to attribute this to the following reasons: (1) Formby is on the sea coast; and during heavy gales from the West, practically the whole of the lamps are exposed to their full force, and great damage to the mantles must necessarily follow—the damage varying in degree according to the power of the wind and the length of time the gales remain. The greatest damage in one night was on Dec. 28, 1900, when 60 per cent. of the mantles had to be renewed on the following day. (2) The pillars, in the writer's opinion, are too weak for the work they have to do—weighing only 2¼ cwt.; thereby allowing a great amount of vibration by vehicles. (3) Moths, spiders, bluebottles, &c., are prominent in the district, and account for good number of mantles being destroyed.

Of the two kinds of lamps in use at Formby—Bellamy's and Pontifex's, the latter fitted with No. 3 Kern burners and Welsbach anti-vibrators—the writer finds practically no difference in the renewals. But from the light diffusing point of view, &c., the Bellamy lamp possesses several advantages over the Pontifex—viz.: (1) The position of the burner being fixed so that the top of the mantle is level with the lamp-reflecting frame, diffusion is carried a greater distance than when the mantle is fixed in the lamp at a low position. (2) The Bellamy lamp can be made recuperative by taking in the air supply at the upper portion of the lamp, provided the base of the lamp is air-tight. This is done at Formby by means of a round rubber disc, 2 inches in diameter by ½-inch thick, having a hole in the centre to slip on to the supply-pipe tightly, and pressing it well down on the bottom of the lamp.

In looking through the "Gas World Directory" statistics, the writer was surprised to find that incandescent street lighting was not more generally adopted than reported on Jan. 1, 1902; and it would perhaps not be out of place to reproduce them. They show that a very large amount of work remains to be done to improve street lighting; and, it is to the interests of both gas managers and undertakings, no matter what size they may be, to take up the subject in a thorough businesslike way, and not in an experimental manner—that stage being now over—if they have not already done so. They will find that it is the cheapest form of advertising a gas undertaking can have; many residents and owners of public buildings not on the Company's books having adopted the incandescent system in the writer's district, and so popularized gas.

Country.	No. of Towns where all Lamps on Incandescent system.	No. of Towns where partially fitted with Incandescents.	No. of Towns where no Incandescent Street Lighting.	No. of Towns where no Street Lighting.	Public Lamps. Total.	Public Lamps. Fitted with Incandescent Burners.
England and Wales	75	572	460	134	544,420	120,993
Scotland	4	119	104	26	83,353	5,891
Ireland	6	44	54	10	25,526	1,549
Total.	85	735	618	170	653,299	128,433

The writer is of the opinion that to make incandescent street lighting a success, the following should be the order of the day:—

1.—Mantles, rods, chimneys, and other goods necessary for repairs should be the best obtainable of their respective kinds.

2.—None but thoroughly practical fitters should be employed to execute repairs.

3.—The most intelligent men obtainable for the wages one is able to pay should be employed in lighting, extinguishing, and cleaning, and that the system of lighting, whether by torch or with ladder and match, should be left to them so long as the work is satisfactorily performed.

NOTES ON WORKING WITH AN ILLUMINATION PHOTOMETER.

By Henry Fowler, of Derby.

[A Paper Presented to the Manchester District Institution of Gas Engineers, Dec. 6.]

Although the question of the candle power of various lights and the maximum amount of light obtainable from a given consumption of gas is one we so frequently hear discussed that it is evident it receives great attention, yet the question of illumination itself seems to be often overlooked. As we all know, this depends not only on the light itself, but on its surroundings, and particularly on their colour and surface. It may be that those whose sole object is the sale of gas are content with the rule-of-thumb instructions given in most text-books, stating that in certain rooms one light for so many square feet of floor will be found satisfactory. The subject, however, deserves greater attention than has yet been given to it, either by gas engineers or electricians.

Undoubtedly, the most convenient form of expressing illumination on a given plane is by means of portions of a candle foot, which is the equivalent of the light of one candle at the distance of one foot. This term has been objected to by some as being a double-barrelled one; and generally in technical words of this character, we mean the product of one of the words by the other; as foot-pound, candle-power-hour, &c. It seems, however, to be the one which most readily expresses this unit of illumination, but it must be remembered that one-half of a candle-foot is the light given by one-half candle at the distance of a foot, which is equal to the light of a candle at the distance of $\sqrt{2}$, or 1·4 feet. The unit "carcel-metre," which has been used in France for some time, is equal to a carcel at the distance of a metre, and equivalent to 1·12 "candle-feet." Some ten years ago, Mr. A. P. Trotter and Mr. W. T. Sugg suggested that the English unit had the advantage of being the illumination to be aimed at for inside lighting; but the author thinks we shall see later that at the present day an even greater degree of luminosity is, owing to improved all-round lighting, often looked for. One is led to wonder what will be the ultimate result of this continued cry for more light, which has undoubtedly been caused by the competition between electricity and incandescent gas.

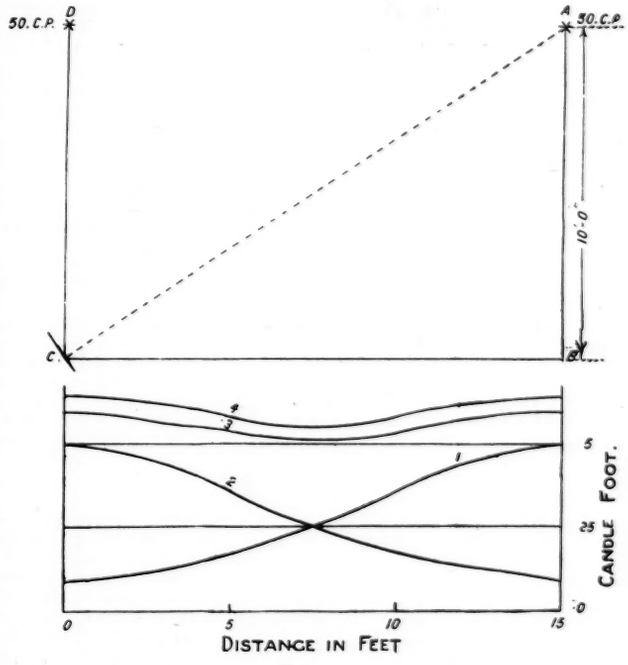


Fig. 1.

The theoretical calculation of the amount of illumination on any plane may be easily arrived at if the whole of the light is concentrated at one point by the following method: In fig. 1, let

A be the source of light, having an intensity of x candles, and B a point directly below it. We know that the illumination at B is equal to x divided by AB^2—AB being in feet, and the illumination is $\frac{x}{AB^2}$ of a candle-foot. At C, on a plane at right angles to AC, the illumination is $\frac{x}{AC^2}$; but on a plane at right angles to AB is $\frac{x}{AC^2}$ multiplied by the cosine of the angle of incidence BAC, and, therefore equals

$$\frac{x}{AC^2} \text{ Cos. BAC} = \frac{x \times AB}{AC^2 \times AC} = \frac{x \times AB}{AC^3}.$$

This is simply the candle power multiplied by the cosine of the angle of incidence and divided by the square of the slant distance, and is therefore inversely proportional to the cube of the cosine of the slant distance. A curve (I.) of the illumination along BC is shown under fig. 1 as a full line, in which x is assumed to be 50 candles and AB to be 10 feet. This is, of course, the curve for a single light. If other lights have to be considered, the illumination along CB is the sum of the respective illuminations of the two lights. Assuming another light to be at D, AD being equal to one-and-a-half times AB, the illumination will be the sum of the curves I. and II., as shown by the curve III. Assuming a number of lights in a row at the same height and distance apart, the resulting illumination is shown by the curve IV.

It often happens that the illumination is not required directly under the lamps as shown, but along a line parallel to it but some little distance from the lights, as, for example, along the edge of the platform of a railway station, the lights being set back from the edge. The illumination curve can still be calculated, with, however, a little extra trouble, as the slant distance requires slightly more working out. These theoretical curves, of course, do not hold in practice, owing to the effect of reflection, which it is almost impossible to calculate with any degree of accuracy.

Various forms of illumination photometers have been devised, and several were described in 1892 by Mr. A. P. Trotter in his valuable and exhaustive paper on this subject.* He there describes an instrument, modifications of which the author has used for some considerable time, for taking illumination curves at various places. In the first types, the source of light was a small incandescent electric lamp worked from a secondary battery, which was stated to give, after being fully charged and then discharged for half-an-hour, a steady current for about three-quarters of an hour. The photometer itself was a very ingenious instrument, and consisted of a box, about 12 inches long, 9 inches high, and 6 inches wide, in one end of which were fixed two small incandescent electric lights, which could be switched on either independently or together. On the top of the box was a small spirit level, and a disc of Bristol board with a star cut out of it. Directly under this, in the box, was an inclined piece of the same material, which could be given any angle, by a system of levers worked from the outside of the box by a long arm ending in a pointer working over a quadrant. The light from the electric lamp shone on the inclined Bristol board, the illumination of which was, of course, dependent on the angle at which the light struck it. The instrument was standardized; the quadrant being marked with the illumination corresponding to each position with either of the lamps.

In order to take a reading, either one or other of the lamps, which were placed at slightly different distances from the screen, was switched on, the eye placed directly over the star in the disc fixed in the top of the box, and the inclined Bristol board worked backward and forward so as to appear alternately lighter and darker than the disc as the angle and illumination varied. The balance was obtained by diminishing the range of the oscillations of the lever until they are small in extent, and yet at their extremities the inclined board looked lighter or darker than the disc. While still moving the arm mechanically, the scale was looked at and the mean of the movement taken.

In the more recent form of photometer, which the author has lately been using, the electric lamps with their secondary battery have been replaced by an amyl-acetate lamp. This does away with the weight and clumsiness of the battery, and with the inconvenience arising from the necessity of re-marking the scale when a lamp broke or burnt out. It is also probably a more reliable standard, but suffers from being redder in colour, affected by wind, and incapable of being used in its present form for vertical illuminations, which are sometimes the most important to note. The latter two of these objections might be overcome; but the interest in the measurement of illumination is so slight that the manufacturers of this instrument (which the author believes the only small practical one which has been put on the market) have discontinued making it—at all events, for the present.

Fig. 2 shows a section through this type of photometer, which is much handier than the earlier one. The body A consists of a tube 3 inches in diameter, to which is attached the stand B, which may be placed directly on the floor, or on a tripod as required. C is the amyl-acetate lamp screwed into the casing D from beneath, which thus allows the flame to be adjusted to a standard height, which is indicated by means of the gauge E. In the diagram this is shown turned slightly out of the way of the flame. The ends G of the photometer are secured by means of bayonet joints—the one near the lamp being provided with a mirror to allow of the flame being inspected without taking the end off. The inclined Bristol board H is directly pivoted to the lever I, the end of which works on the quadrant marked with the reading in parts of a candle foot. The disc J is held down by a circular rim, and has in it a slot lying at right angles to the axis of the

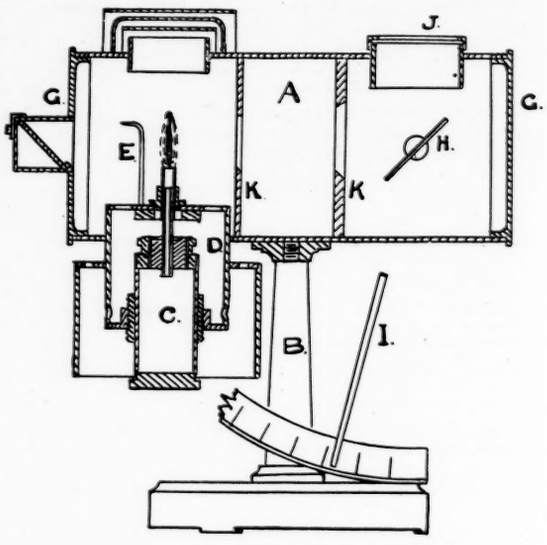


FIG. 2.

barrel, which the author thinks a great advance over the open star in the earlier instrument. K are metal screens with pear-shaped holes in them, which prevent to some extent the stray reflection which takes place in the interior of a box, however carefully it may have been blackened. The scale is marked for reading from 0 to 2·2 of a candle-foot; the amyl-acetate lamp giving on the bar 0·25 of a candle. As very feeble illuminations, as met with in street lighting, ordinary Bristol board is too coarse to allow of careful readings being taken, as its rough surface becomes unequally illuminated. The author thinks that, for very small illuminations, an arrangement somewhat similar to a Methven screen for taking part of the flame would be found advantageous. Probably a few illumination curves taken from actual lighting might be of interest.

The author had intended first showing the lighting along the edge of his desk, which is lighted by a single incandescent "C" burner under an opal shade; but he found that the illumination was far greater than the maximum the photometer would measure. He was, therefore, driven to take a curve with the photometer on the floor, which made the disc 8 inches above it and 5 ft. 10 in. below the light; the distance being measured in this, as in other cases, from two inches above the bottom of the chimney. The centre reading was taken with the disc at 3 ft. 3 in. away from a point directly under the light; readings being taken every foot for 3 feet on either side. The result is shown by curve I. fig. 3; the slight irregularity of the curve being probably due to the opal shade not being evenly crinkled at the edge, and to varying reflections due to white papers on the wall.

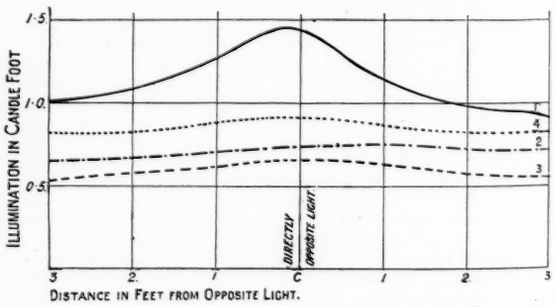


FIG. 3.—ILLUMINATION ALONG FLOOR OF OFFICE.

After this, the shade was removed from the fitting, and a fresh set of readings taken, which are shown by curve II., fig. 3. It will be noted that the shade not only increases the light along the floor, but tends to concentrate it directly underneath the shade. The burner was then moved to the photometer room, and a curve taken with the illumination photometer under precisely the same conditions as in the office; the result being shown as curve III., fig. 3. These curves, the author thinks, are interesting, as they show the comparative effect of an opal shade and simple reflection from walls and ceilings, as compared with the result obtained in a dark room. The office in which the readings were taken is 25 ft. 6 in. long by 15 feet wide and 11 feet high; the paper on

* See "JOURNAL OF GAS LIGHTING," Vol. LIX., p. 966.

the walls being a dark terra-cotta and the ceiling whitened. After the above tests, the burner was tested on the photometer bar, and found to give 56 candles. From this, the theoretical illumination curve was calculated, and is shown No. IV., fig 3. It will be noticed that this curve, although very similar in shape to curve III., is higher than both it and curve II. This is due to a portion of the mantle being hidden by the burner, which will account for the difference. The whole of these tests were made the same afternoon, and with the same mantle and burner, with gas from the same holder. The pressure in each case was higher than would give the best effect with the mantle, and reduced until the greatest illumination was obtained.

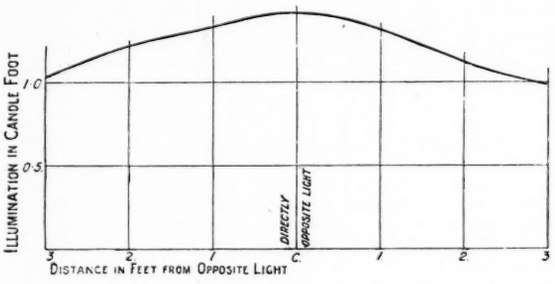


FIG. 4.—ILLUMINATION ALONG EDGE OF DINING-TABLE.

Fig. 4 is a curve taken along the edge of the author's dining table which is lighted by an incandescent light under an opal shade on a fixed pendant over the table. With the table in its usual position under the light, the illumination was, however, found too high to measure, and the curve could only be obtained by pushing the table on one side until the disc on the photometer was 5 ft. 9 in. from directly under the light, and 2 ft. 10 in. beneath it. The room is 14 feet by 13 feet and 10 feet high, and the paper a fairly light colour, in which light bluish grey predominates. This reading, and the results given in connection with fig. 3, show that ordinary well-lighted interior surfaces require more light than the single candle-foot, thought sufficient in 1892.

Illumination 8 inches from the floor of the author's drawing-room is shown in fig. 5, starting directly beneath the single

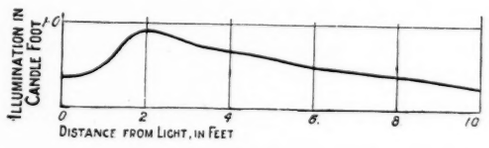


FIG. 5.—ILLUMINATION ALONG FLOOR OF DRAWING-ROOM.

bracket with an incandescent mantle and ice globe, which is the only light. The result and effect are good; but the mantle has been in constant use for nearly two-and-a-half years, and is now frayed and worn at the bottom. The room is about 14 feet by 13 feet and 10 feet high, and the paper a light yellow of excellent reflecting quality.

Fig. 6 shows two curves taken from street-lamps, in each case the reading starting 5 feet from the post. Curve I. is of a large single flat-flame burner (about 8 feet per hour) standing 9 feet above the photometer disc, whilst curve II. is from a single incandescent "C" burner with the mantle in fair condition and 11 ft. 10 in. above the disc. The better diffusion of the light on the

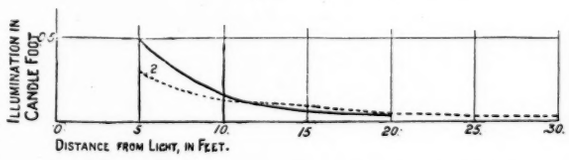


FIG. 6.—ILLUMINATION ALONG STREET FROM TWO LAMPS.

higher post will be noted. The difficulty of taking readings with very feeble illumination prevented the curves being extended farther. It will be noted that the curves in the diagrams submitted are, owing to lack of space and for clearness, not drawn to the same scale.

The author apologizes for not having given this fascinating subject the fuller attention it deserves; and his only apology for presenting these few notes is the hope that they may persuade some other member of the Association to take up this interesting work. He wishes to acknowledge his indebtedness to Mr. S. W. Johnson and Mr. H. A. Hoy for their kindness in lending their photometers shown on the table, and to Mr. W. E. Caton for his help in taking the curves.

THE FUTURE OF COAL GAS AND ALLIED ILLUMINANTS.

[A Series of Cantor Lectures delivered before the Society of Arts.]

By Professor VIVIAN B. LEWES, Royal Naval College, Greenwich.

II.—Monday, Dec. 1.

In the last lecture, I traced the changes that had taken place in the conditions of gas supply, and showed why an illuminating gas of comparatively low light-giving power and good calorific value would be the need of the future. We can now proceed with the discussion of how this gas is to be best obtained. Having gone into the question of what may be expected from high temperatures in carbonization, we can proceed to consider the effect of blue water gas as an economical diluent; taking as a dominating factor that we must not add more than 40 to 43 volumes of blue water gas to 100 volumes of coal gas, for fear of raising the percentage of carbon monoxide in the mixed gases above the advisable limit, and because, directly that amount is exceeded, it begins to interfere with the action of atmospheric burners as adjusted for coal gas, and tends to cause flashing-back.

The only successful processes used in Europe and America for the production of water gas have depended on the system introduced by Gillard in 1849, in which the temperature of a burning carbonaceous fuel, such as coke or anthracite, was raised to incandescence by means of an air blast, and then steam was passed through the incandescent fuel, with the formation of water gas, until the temperature had been lowered to a point at which carbon dioxide began to appear in the gas to a serious extent, when the steam was cut off, and the fuel again blown up to the required temperature by the air blast; the only differences in the systems adopted being in the form of plant and the arrangement of valves employed.

In all forms, however, up to 1895, but little attention was paid to the ratio existing between the air blast employed and the fuel in the generator; and the result of urging the carbonaceous fuel to incandescence was to obtain a gaseous product generally known as producer gas, the composition of which is—

Nitrogen	63·64 per cent.
Carbon monoxide	29·33 ,,
Carbon dioxide	4·15 ,,
Hydrogen	2·88 ,,
	100·00

Under certain circumstances, this can be used as a poor fuel gas, as it contains some 32 per cent. of combustible matter.

In order to raise the temperature of the fuel, however, to a sufficiently high point for the formation of 1000 cubic feet of water gas by the passage of steam through it, 44 lbs. of carbon had to be consumed during the blow, which yielded 4000 cubic feet of producer gas. This, in the processes for making blue water gas, was blown to waste at the mouth of the generator; while another 15 lbs. of carbon were consumed by the action of the steam in making the 1000 cubic feet of water gas itself. So that this amount of gas meant the consumption of about 60 lbs. of carbon. The average yield of water gas per ton of coke by this process was 34,000 cubic feet, which represents only some 34 per cent. of the thermal value of the carbon from which it was formed. It is quite clear, therefore, that such a loss as this would prevent the economic use of water gas made by such a process from being successful.

The plea put forward in favour of blue water gas as a fuel at this period was that one had the fuel in the form most easy of application, and that also, by utilizing the producer gas as a fuel, the heat to be obtained from it brought the total calorific value of the two mixtures up to 80 per cent. of the thermal value of the carbon used. This argument as regards thermal efficiency was, however, purely fallacious in practice, as the two gases being produced intermittently, they would have to be stored in order to utilize them separately. The enormous bulk of the producer gas as compared with its thermal efficiency would therefore have required such an amount of storage room as to render such use of it impossible; while if stored, and therefore cold, it would have to be reheated before it could be got to burn, owing to the 68 per cent. of nitrogen and carbon dioxide diluting the combustible gases. The introduction of carburetted water gas, however, provided a really successful method of utilizing the heat given off during combustion by the producer gas, as in the beautiful forms of apparatus devised for making the carburetted water gas one really has a heat engine which does its work in a perfect way.

During the blow, the producer gas, red-hot from the generator, was consumed, with the requisite quantity of air, in the chequer brick, cracking, and fixing chambers, which were to decompose the oil and convert it into a permanent gas. By the time the right degree of incandescence had been arrived at in the generator,

the chambers designed for the manufacture of oil-gas had also reached the required temperature; so that when the air blast was cut off, and steam was admitted to the incandescent coke in the generator, and a stream or spray of oil passed into the cracking chambers, one had at once a process for making the carburetted water gas proceeding under the best conditions, as the hot water gas, sweeping forward through the cracking and fixing chambers, washed out from them the oil gas as it was produced, and saved it from over-decomposition by contact with the heated walls of the chambers. In reality, in all those forms of carburetted water-gas apparatus which have arisen as improvements of Lowe's original ideas, we have the full thermal value of both the producer and water gas being utilized.

On the Continent, however, where the oil supply is not under such favourable conditions as in this country, an economical method of producing blue water gas still remained one of the greatest needs of the technical world. It was in 1896 that Carl Dellwik gave a method of making water gas to the manufacturers, which in simplicity and ease of working could not be surpassed, and which in one step did away with the production of the well-nigh useless producer gas, and doubled the output of water gas per ton of fuel. In the spring of 1897, I had the privilege of investigating this process at the little Westphalian town of Warstein, where Dellwik had the system installed; and in June of that year, I gave a lecture before the Incorporated Gas Institute at their Bath meeting. In that lecture, I gave the results I had obtained while working with the apparatus, and at the present day gather considerable amusement and pleasure from looking back to the criticisms and remarks which were aroused at that time. An American correspondent of mine took the trouble of writing to one of the leading gas experts in Germany, asking for his opinion on the figures I had given. The reply received was that the results were absolutely impossible; and the writer was evidently not clear in his own mind as to whether I had been sufficiently intoxicated to have seen the results doubled, or was so incapable as not to be able to perform the experiments. I was, however, pleased to see, a year later, that the same gentleman had investigated the process himself, and given identically the same figures; and he is now one of the most ardent supporters of the system.

In this process (which I have described in this room already on more than one occasion, and which I need only now therefore touch upon), by careful regulation of the grate surface and the height of the fuel bed, and by careful regulation of the air blast, instead of bringing about incomplete combustion in the generator while blowing up to incandescence, and getting producer gas as a bye-product, the ratios are so arranged as to give complete combustion, and to yield practically ordinary flue gas during this process. This means that the carbon monoxide produced in the old process of blowing was now burnt in the generator itself, instead of in a supplementary chamber, as in the case of the Lowe process; and the extra temperature due to its combustion was given to the fuel, thereby raising it to incandescence in much shorter time than had been the case heretofore, and so reducing the amount of fuel consumed. Burnt up by the excess of air during the blow, the carbon is converted into carbon dioxide, and not carbon monoxide; so that, instead of developing 2400 heat units per pound of carbon, it develops 8080 units for the same consumption, or an amount 3·37 times as great.

Having reached incandescence in this, the only rational and economical way, the fuel is then subjected to the action of steam; but the steam supply is so regulated that it is never at any time in excess of the quantity required for the formation of water gas. By this means, oxidation of the carbon monoxide to carbon dioxide by steam, which always takes place to a small extent in the old process, is here avoided; and the result is that, with a decent coke, it is possible to produce 70,000 cubic feet of water gas per ton of carbon, as against 34,000 cubic feet with the old processes—a result which now makes water gas the most important factor in obtaining high temperatures. It is by this process that the blue water gas will have to be made in the future, if it is to be successfully employed as an adjunct in the manufacture of an economical low-grade gas.

Many experiments have been made with a view of seeing if the generators utilized for making water gas for the formation of carburetted water gas could be used on the Dellwik lines. It was soon found, however, that the alterations necessary cost far more than a new plant, and that an increase in the amount of air blast is by no means the only thing required to give the improved results, as, unless this is accompanied by a careful regulation of the ratio between the fuel, grate area, and air blast, but little improvement can be obtained. Many attempts have been made in America to get away from the Dellwik patents by experiments in this direction. I was pleased to hear the other day from one of the leading water-gas makers in America that, although he had blown his generators until, as he put it, the country round was an inch deep in ashes, he had absolutely failed to get any result approaching that given by the Dellwik plant.

Taking, now, our water gas made in the most economical way, we can proceed to see how it can be best used for diluting coal gas down to such standards as may hereafter be fixed upon, Mr. T. O. Paterson, in his inaugural address to the Incorporated Gas Institute last year, gave some most valuable figures on the relation of illuminating power and calorific value in gases, and tabulated the effect of diluting coal gas with uncarburetted water gas as follows:—

Percentages.	Illuminating Power.	Calorific Power.		B.T.U. per Candle.	
		Gross.	Net.	Gross.	Net.
	Candles.	B.T.U.	B.T.U.	B.T.U.	B.T.U.
100 coal gas	19 29	674·5	606 2	35·0	31·4
90 ,, and 10 water gas . .	18·45	646·0	581·0	35·0	31·5
80 ,, 20 ,, . .	16 67	615·8	555 6	36·9	33·3
70 ,, 30 ,, . .	14 26	585·1	528·9	41·0	37·1
60 ,, 40 ,, . .	11·89	544·1	485·1	45·8	41·6
50 ,, 50 ,, . .	9·88	515·8	468·4	52·2	47·4
40 ,, 60 ,, . .	5·08	469·0	427 1	91·8	83·3
30 ,, 70 ,, . .	under 1·0	436 8	399·4	..	..
20 ,, 80 ,, . .	..	404 5	370·7	..	..
10 ,, 90 ,, . .	..	372·2	342·0	..	..
100 ,, . .	..	333·0	306·8	..	..

It will be seen from this that the thermal value per candle of illumination becomes higher with considerable rapidity as the candle power of the gas is reduced. This manifestly must be so, as when the coal gas contains 70 per cent. of water gas, the effect of dilution upon the hydrocarbons present is to render them non-luminous; while the net calorific value is still close on 400 B.T.U. The effect which the initial candle power of the gas has upon the effect produced by diluting it with blue water gas is of the greatest importance in considering the formation of our low-grade gas, as it is manifest that, in making a cheap gas, one would never use coals of a quality which would give 19·29 candle coal gas. My first series of experiments in the direction of trying how best to make a low-grade gas of satisfactory heating power, was to try the effect of diluting coal gas of different calorific values with blue water gas; the gases being mixed *pro rata* as they flowed into the holder, and being allowed to stand over night to complete the mixing.

In practice, if a 16 per cent. limit was fixed by Parliament for the carbon monoxide in the gas, it would be manifestly unwise to approach the limit too closely, as, during a press of work due to fog or other causes that throw a strain on the resources of the works, a slight want of uniformity in mixing might bring the percentage above the limit; and in these experiments 40 volumes of blue water gas were added to 100 volumes of coal gas, which would give 28·5 per cent. of water gas in the mixture, and bring the carbon monoxide up to about 14 per cent. The gases were measured through a meter before mixing; and the resulting mixture was tested for calorific value in a Junker's calorimeter. The blue water gas used was purified from carbon dioxide, and had a calorific value of:

Calories per cubic foot	80 gross	..	73·4 net
British thermal units	320 ,,	..	293·6 ,,

The results obtained are shown by the following table:—

Illuminating Value of Coal Gas.

Candles	17·6	16·0	15·3	15·1
Thermal Value of Coal Gas.				
Calories, gross . . .	172·0	159·9	158·8	149·9
,, net	155·3	143·8	142·0	134·6
B.T.U., gross . . .	688·0	639·6	632·0	579 6
,, net	621·2	575·2	568·0	538·4
Mixture.				
Calories, gross . . .	146·0	135·6	136·8	129·1
,, net	131·7	122·8	123·2	116·7
B.T.U., gross . . .	584·0	542·4	547·2	516·4
,, net	526·8	491·2	492·8	466·8
Percentage Reduction in Thermal Value.				
Gross	15·1	15·2	13·4	13·9
Net	15·1	14·6	13·4	13·3

This table shows that, given an ordinary gas coal such as we should in practice use, yielding 10,000 cubic feet per ton of a 15 to 16 candle power gas, it may have added to the 10,000 cubic feet 4000 cubic feet of blue water gas, with a percentage reduction of only 13 to 15 per cent. in thermal value. The experiments made by Mr. Paterson and others show that the reduction in candle power is practically proportional to the volume of water gas added, as one would expect; so that the candle feet per ton of coal carbonized would be practically the same whether they were present in 10,000 cubic feet of coal gas or 14,000 cubic feet of the mixture.

Instead, however, of mixing the blue water gas with the cold coal gas, a distinct advantage is to be gained by passing the gas into the foul main. This is done at several places in Germany, notably at Erfurt; and it is found that a distinct saving in candle power is obtained, owing to the water gas becoming to a slight extent carburetted with benzol vapour present in the hot gas, which, if allowed to cool, would be taken up by the tar. I regret to say that I have no direct figures which show the result of percentage admixtures made in this way of blue gas and coal gas, as in all the works where it is used the mixed gases are benzolized—*i.e.*, enriched to a small extent by benzol before being sent out; and the saving is found by less benzol being required to bring the gas up to a given candle power when the mixture is made in this way

than when, as is done in some other places, the water gas is enriched with benzol and afterwards mixed in with the gas.

In utilizing water gas for the dilution of coal gas, it is possible, however, to make it perform a far more important function than that of merely increasing the volume. One of the weakest points in the manufacture of coal gas is to be found in the process of carbonization, which has undergone little or no change since the earliest days of the gas industry. When the coal is placed in the hot retort, evolution of gas at once commences with great rapidity; and working with a five hours' charge, the largest proportion, and the richest portion, of the coal gas is evolved during the first three hours. The general course of the reactions is well shown in the following table of results, found by Mr. Lewis T. Wright in his studies on carbonization.

Time of Observation.	Total Gas Evolved.	Average Retort Temperature.	Candle Power per 5 Cubic Feet.
Seconds.	Per Cent.	Degrees.	Candles.
30	12·3	1108	21·8
60	26·1	1212	20·2
90	38·9	1200	17·7
120	52·6	1292	14·8
150	65·8	1315	13·5
180	78·6	1360	11·7
210	86·5	1435	10·7
240	92·6	1531	7·1
270	96·4	1613	5·1
300	100·0	1671	3·8

A moment's consideration of the actions taking place during carbonization shows that, whereas in order to obtain the best results the coal gas during retorting ought to remain under absolutely uniform and reliable condition of temperature and time of exposure to the heat of the retort, yet these are the very factors which it is absolutely impossible to obtain under existing circumstances. The gas and vapours generated from the coal at the mouth end of the retort have only a very short exposure to radiant heat from the walls of the retort, as they are hurried out by the volume of gas behind them, and therefore leave almost unacted upon by the heat; while the gas from the extreme end of the retort, having nothing to urge it forward, gets largely decomposed by over-heating. The result is that, not only are many of the heavy hydrocarbons, which would have been of the greatest value as illuminants to the gas, broken down into methane, hydrogen, and carbon, but also the over-baking yields a large percentage of the naphthalene found in the tar and mains.

It has always been a dream of the gas manager to devise some process which would enable him to decompose the tar formed during destructive distillation, and, by getting from it hydrocarbons of high illuminating value, to do away with enrichment by other and more costly processes. Many attempts have been made in this direction; but so far, the only way in which tar has shown itself of value as an enricher has been to separate from it the benzol, and then return that benzol to the gas in the carburettor. I have many times pointed out that, when once formed, tar is one of the most difficult bodies to again decompose, and that its formation was really due to two distinct sets of actions—a primary action in which liquid hydrocarbons distil as vapours from the less heated portions of the coal in the retort and, escaping decomposition by the radiant heat from the crown of the retort, condense as liquids again on cooling, while a secondary reaction is of a synthetic character, and results in the formation of naphthalene carbon and many of the heavier constituents of the tar by the polymerizations and decompositions taking place in the heated crown of the retort at the expense of hydrocarbon gases which ought to find their way unaltered into the gas, and that the only rational method of getting the benefit of the hydrocarbons which are at present lost as tar, is to prevent their conversion into that body.

In a lecture I gave before the Incorporated Institution of Gas Engineers in 1900, I suggested that, instead of using water gas merely as a diluent, it should be made a factor in the distillation itself. I proposed that a stream of water gas should be passed through the crown of the retort during the process of carbonization, so as not only to hurry the newly-born hydrocarbon gases out of contact with the hot walls of the retort, but also, by diluting them, to prevent the secondary reactions taking place, which were so important a factor in the production of tar, and by so doing to save many of the important lighting and heating constituents from destruction.

Through the kindness of Sir George Livesey and Mr. S. Y. Shoubridge, experiments were shortly afterwards made at the Crystal Palace District Gas-Works, and gave results which pointed to this method of utilizing water gas being of the greatest possible importance to the future of coal gas. In these experiments, a Derbyshire coal was employed; and the yield of gas and candle power given by the coal were tested on a large scale before, during, and after the water gas experiments. It was found that, under ordinary conditions of carbonization, it yielded 10,468 cubic feet per ton of 15·88-candle power gas. The plant used in the earlier experiment consisted of six beds of seven retorts each, and, later, of twelve beds of seven retorts; the section of all the retorts being 22 in. by 16 in. and 20 ft. long, heated by regenerative furnaces, and charged by power stoking machinery. The gas from them was passed through one complete section of the works separately, and was therefore condensed, scrubbed, purified, and measured in the usual way—ordinary gas manufacture being carried on the time in other sections of the works.

The water gas was made in the ordinary "Economical" water gas plant, and conveyed from the relief holder to the retort-house by a special pipe. This pipe was continued over the retort-bench, just above the arch-pipes on one side, and a connection was made from it to the top of each ascension-pipe on this side of the bench. Each connection was fitted with a cock having a lever handle with rod attached to it; so that the cock could be regulated from the charging floor. The dip-pipes on this side were blocked, and the hydraulic main valves closed. The water gas, therefore, descended the ascension-pipes on this side, passed through the retort, and up the ascension-pipes on the other side along with the coal gas. The quantity of water gas which could be passed through each cock, when partly and when full open, was ascertained before the test by measurement through a meter. This enabled an approximate measurement of the quantity of water gas put into each retort to be made; but the actual amount used in each experiment was checked by noting the quantity taken out of the holder. The heat of the retorts was maintained as nearly uniform as possible throughout the tests, and at as high a temperature as is used in ordinary working. Many experiments were made in this way, all of which showed that important ecomomies could be attained by the process; and the following experiment will give an idea of the result obtained by using the 40 per cent. of blue water gas in this way, as compared with the 40 per cent. simply mixed with the coal gas.

Coal carbonized	82 tons
Make of mixed gas per ton	13,730 cubic feet
Water gas added per ton	4,005 ,, ,,
Percentage of water gas added	41·1 per cent.
,, ,, ,, in mixture	29·1 ,,
Candle power	14·87 candles
Candle feet $\frac{13,730 \times 14·87}{5}$	40,833 ,,
Standard $\frac{10,468 \times 15·88}{5}$	32,446 ,,
Gain in candle feet on standard	25 per cent.

Analysis of Gas.

	I.	II.
Hydrogen	50·37	50·62
Saturated hydrocarbons	29·24	29·49
Unsaturated hydrocarbons	2·98	2·48
Carbon dioxide	0·49	0·49
Carbon monoxide	14·92	14·92
Oxygen	Nil	Nil
Nitrogen	2·00	2·00
	100·00	100·00

Calorific Value.

Calories	149·8 gross	132·9 net
British thermal units	599·2 ,,	531·6 ,,

These experiments were renewed in 1901, with inclined retorts instead of horizontal; and a bench of 70 inclined retorts, which had been newly erected, was utilized for the purpose. The water gas was made, as in the previous experiments, in the generator of the "Economical" plant usually employed for the manufacture of carburetted water gas. The gas was passed into a holder of 469,800 cubic feet capacity, and thence was carried to the inclined retorts, into which it entered at atmospheric temperature. The gas was not purified before being admitted to the retorts; but it was tested for carbon dioxide, of which it contained from 5 to 6 per cent. The carbon dioxide, after estimation, was deducted by calculation from the volume of water gas used, because the volume of mixed gas produced was measured in station meters after the whole of the carbon dioxide had been removed by purification in the usual manner. To ascertain whether the carbon dioxide in the water gas was converted into carbon monoxide by passage through the retorts, the mixed gas was examined at the inlet to the washers, and found to contain 3 per cent. of carbon dioxide. It may, therefore, be assumed that the carbon dioxide as it passed through the retorts was not converted to any appreciable extent into carbon monoxide.

No station meter could be placed at my disposal for the measurement of the water gas. The holder of known capacity (469,800 cubic feet) was therefore filled before the commencement of each experiment—no gas being admitted to the holder during any trial. The volume of the gas was obtained by recording the height of the holder at the commencement and completion of the experiment, and making all the necessary corrections for temperature and pressure. The quantity of water gas used during twenty-four hours varied in the different experiments from 200,000 to 370,000 cubic feet. The gas leaving the retorts was purified in the usual manner, and then passed through station meters, from which readings were made every hour. During every hour the gas was slowly bye-passed into a small holder, from which gas was drawn at the completion of each hour for the determination of the illuminating power by means of the Referees' table photometer, and from which once every day gas was drawn for analysis, and for the determination of its calorific power by means of a Junkers calorimeter.

The coal used in the experiments was the same kind of Derbyshire coal as had been used in the previous tests, but of slightly inferior quality. Before commencing the experiments with water gas, a trial run was made for seven days with the coal alone; the tests being made every hour, day and night, so

as to obtain a standard for comparison. The principal results obtained were:

Total coal carbonized	603 tons
Total gas made (corrected)	5,973,682 cubic feet
Make per ton	9,907 ,,
Average illuminating power (table photometer)	16·55 candles
Total tar (hydraulic)	5,060 gallons
Tar per ton	8·3 ,,
Calorific power, gross	152·6 calories per cubic foot.
,, ,, net	138·8 ,, ,, ,, ,,

The above gives the value of 32,792 candle feet per ton for the coal; and this figure is taken as the standard in the following experiments.

In arranging the apparatus for the experiments, the upper mouthpiece of each retort was fitted with a pipe and stopcock for the admission of the water gas. These experiments were continued from June 19 to Aug. 23, 1901, and passage of water gas in varying proportions through the retorts was tried, and also the influence of the period of carbonization at which the flow of diluting gas was started. It was found that although the results obtained were far better than in the experiments made with the horizontal retorts, they were of the same kind, and that the gain in candle feet per ton gradually rose with increase in the volume of water gas used, reaching a maximum with about 40 volumes of water gas per 100 volumes of coal gas, and decreasing when this point was passed.

Water Gas added per cent. of Coal Gas.	Candle Feet per Ton of Coal.	Percentage Gain per Ton of Coal in Candle Feet.
21·9	37,582	14·6
25·5	38,235	16·6
27·8	41,343	26·0
37·6	40,936	24·8
40·1	43,703	33·2
42·0	42,984	31·0
45·6	40,467	23·4

The most important data with regard to these experiments were given in a table at the end of a paper read before the International Engineering Congress at Glasgow last year; but the results are so extraordinary, and so full of interest, that it is as well to give the full data for two experiments (in which 40 and 42 per cent. of water gas respectively were added), as it gives a better idea of the scale of the experiments.

First Experiment.

Coal used	85·4 tons
Total make (corrected)	1,274,656 cubic feet
Make per ton	14,925 ,,
Illuminating power (table photometer)	14·4 candles
Total tar (hydraulic)	690 gallons
Tar per ton	8·07 ,,
Water gas added	42·0 per cent.
Water gas in mixture	29·5 ,,
Water gas per ton of coal carbonized	4,415 cubic feet
Candle feet per ton $\frac{14,925 \times 14·4}{5}$	= 42,984
Standard for coal carbonized alone	32,792
Increase in candle feet	31·07 per cent.

Calorific Value.

Calories	127·2 gross	..	116·8 net
B. T. U.	506·8 ,,	..	467·2 ,,
Carbon monoxide present in purified gas, 14·0 per cent.			
Gain in calorific value	25·5 ,,		

Second Experiment.

Coal used	88 tons
Total make (corrected)	1,294,946 cubic feet
Make per ton	14,715 ,,
Illuminating power (table photometer)	14·85 candles
Total tar (hydraulic)	651 gallons
Tar per ton	7·4 ,,
Water gas added	40·1 per cent.
Water gas in mixture	28·6 ,,
Water gas per ton of coal carbonized	4,215 cubic feet
Candle feet per ton $\frac{14,715 \times 14·85}{5}$	= 43,703
Standard for coal carbonized alone	32,792
Increase in candle feet	33·2 per cent.

Calorific Value.

Calories	125·8 gross	..	118·7 net
B. T. U.	503·2 ,,	..	474·6 ,,
Carbon monoxide present in purified gas, 15·2 per cent.			
Gain in calorific value	22·4 ,,		

So that a gain of 31 to 33 per cent. in candle feet and 22 to 25 per cent. in total calorific value is attained.

One point which should be clearly borne in mind when using water gas to clear the hydrocarbon compounds out of the retort, is that cold water gas will have a cooling effect upon the crown of the retort and upon the gases evolved by the coal. Every gas manager knows, to his cost, that unless the temperature in the ascension-pipe rises above 470° to 490° Fahr., he runs great risk of choked pipes. Although the admixture of water gas reduces—and, indeed, does away with—stoppages, owing to alteration in the character of the tar and dilution, yet the cooling of the gas, if carried to extremes, is quite capable of bringing about the very trouble that the process, when properly applied, would entirely prevent; and this is one reason why hot water gas should be employed in preference to cold. If, however, the conditions are such that the use of hot water gas is an impossibility, then the passage of the diluting gas should not be carried on for too long, as Mr. Foulis has shown that the temperature of the gases in the ascension-pipe, at a distance of 18 inches from the mouthpiece, average 890° Fahr. (476° C.) shortly after the charge is introduced, and fall to 518° Fahr. (287° C.) towards the end of the charge.

It is evident from this that, in order to maintain a temperature of not less than (say) 500° Fahr. (277° C.) 18 inches above the mouthpiece, a very large proportion of water gas may be used during the first two hours of distillation, and then should either be reduced or cut off; the latter being the course most likely to be adopted in practice. During carbonization, the large volume of gas which is evolved in the earlier periods of the charge is that which contains the highest proportion of rich hydrocarbons; and these are the compounds not only of highest illuminating value, but the ones most liable to be broken down into less valuable illuminating bodies by undue heating, while the gases evoked in the later stages of carbonization are of low illuminating power, and will withstand a higher temperature.

This falling off in the quality of the gas during carbonization is partly due to decrease in the quantity of gas evolved, leaving the gas exposed too long to the action of the heated walls of the retort, and still more to the fact that, as the heat in the retort acts upon the charge of coal, it is the large outer surface which is first affected—the bottom of the charge by direct contact with the retort, and the upper portions by radiation from the walls. Messrs. Folkard and Heisch showed that with 6-hour charges only one-sixth of the coal remained uncarbonized at the end of the third hour; and this remained as a core in the charge surrounded by a crust of 3 inches of coke. As this coke would be at a temperature not very far below that of the retort, the heavy hydrocarbons evolved during the last period of the carbonization would have been so degraded by filtering through the heated crust, that the water gas would have but little chance of showing any profitable influence. That this is so, is indicated by the fact that, in experiments made with cold water gas introduced an hour after carbonization had started, and carried on for three hours—*i.e.*, until four hours of carbonization had elapsed—a gain of only 16 per cent. in candle feet was obtained; while when the water gas was admitted directly after the charge, and was continued for three hours, a gain of 33 per cent. in candle feet resulted.

In order to show the greatest gain from the process, the water gas would have to be brought in a pipe through the retort itself, so as to be heated to the same temperature as the retort, and should then be discharged in the body of the coal so as not only to hurry the gas out of the retort, but also out of the coke. To do this in a practical way, so as not to interfere with the charging and drawing of the retort, is, I admit, an engineering difficulty. But I think if the value of the process was realized, it would soon be found possible, with horizontal retorts, to have the water gas tube, perforated at intervals, fixed on the bottom of the retort, and to slide in the charge of coal in a sheet-iron tray loosely fitting the retort, and with a perforated and recessed ridge in its lower portion, which would slide over the water gas supply-pipe; while the coke would be withdrawn in the tray when carbonization was completed, and a fresh tray slid in to take its place. In this way, the water gas would be heated in the pipe, and would pass through the charge, washing out the escaping gas, and giving a further gain. I fear, however, that the water gas itself would, under these conditions, attack an iron tube, and that a porcelain or fire-clay tube would have to be used. The process has been tried at Remscheid in Germany, and has given results of the same character as those recorded here; while stopped ascension-pipes, which were a constant trouble with the class of coal used there, have been reduced to one-third the previous number.

There is one point which must be clearly borne in mind by the gas manager in considering the economic use of water gas in the dilution of coal gas and the distillation of coal, and that is that the output of the works must be large enough to keep the water-gas generator continuously employed, as it is only under these conditions that the expenses can be reduced to a minimum. And while it is perfectly possible to make water gas by the Dellwik process at a little over 3d. per 1000 cubic feet when the plant is being worked to its full capacity, the price will naturally increase where the size of the works only demands its being used for a few hours a day. In large works, blue water gas will in the future be an absolute necessity; but in the hundreds of small works that supply our country towns, the benefits to be derived from its use are minimized to an almost vanishing point by the extra cost of production of a comparatively small quantity of gas. I have during the last ten years given a large amount of time to the question of how best to supply small works with an ally which shall prove of as much value to them as the Dellwik plant to their larger brethren.

Mr. Tully, of Sligo, some two or three years ago, had a long conversation with me on the subject; and acting upon the suggestions which I have made to him from time to time, he has perfected an apparatus which should be of the greatest possible value where the gas supply is only of moderate dimensions. At the present time, the recovery of benzol from the coke-ovens on the Continent has so increased the output of this material, that

tar, which used to be the only practical source from which it could be obtained, has fallen in price until many works would be glad to dispose of all they produce at 1d. per gallon. Indeed, in many cases it is being used as a fuel in the works; and the only way in which the price of small quantities of tar can be kept up for special purposes is by reducing as far as possible the amount for sale. The lines on which Mr. Tully has been working have been to take my idea of decomposing hydrocarbons, such as heavy oils, in the fierce heat of the fuel of the water-gas generator itself, instead of in cracking chambers as is usually done in making carburetted water gas—a process which demands not too heavy a grade of oil—and adapt it to the decomposition of tar; so regulating the temperature and the volume of tar that the latter is completely decomposed to carbon methane and hydrogen, together with small traces of more valuable illuminating hydrocarbons, and then to filter off the finely-divided carbon produced by passage through the coke which is afterwards to feed the generator.

The apparatus which Mr. Tully has designed for this purpose consists of an iron shell lined with fire-brick and provided at the bottom with clinkering doors; and the fuel used in it is, under ordinary circumstances, coke, although, of course, anthracite, or even a certain proportion of bituminous coal mixed with coke, may occasionally be employed. The fuel, after ignition, is raised to incandescence by air blasts from jets arranged close to the bottom of the generator. These air injectors carry in their interior the steam-pipes; so that, when the necessary degree of incandescence has been reached, steam can be directed on the hottest part of the fuel. In the generator lining, about midway, is a flue provided with openings into the generator. This flue passes entirely round the generator, and has its exit into a stack-pipe closed at the top by a snift-valve. The top of the generator has another exit leading into the upper part of the stack-pipe. In this way, during the blow the products of combustion are led away through the openings into the flue, ensuring a bed of incandescent fuel of constant height; and at the same time, when steam is turned on, the resulting gases can be drawn off through either of the exits. Between the flue and the floor of the generator is a constriction, in the space below which are arranged the injectors by means of which the tar is driven in by steam pressure.

In actual working, the fuel is first raised to incandescence by the air blasts in the lower part of the generator, and the products, consisting of little else but carbon dioxide and nitrogen, escape into the air through the flue—the snift-valve being left open. When the desired temperature has been attained, the snift-valve is closed, and tar or other heavy hydrocarbons are injected by steam into the annular space below the constrictions. Rising through the incandescent fuel, both the hydrocarbon and the steam are decomposed—the former into soot and gaseous products, while the latter yields water gas. During this time, some steam is injected through the pipes in the interior of the air-jets, by which means the clinker is broken up and more water gas formed. The mixed gases then pass upwards with the finely-divided carbon from the decomposition. The carbon is removed by passing through the fuel in the upper part of the generator; and being brought down as the red-hot fuel sinks, it reaches the zone of action, where it is at once utilized for decomposing the steam before the larger masses of fuel are acted on, on account of its finely divided condition. The gases—consisting of a mixture of hydrogen, methane, and carbon monoxide—pass away through the stack-pipe by a cross-pipe, which is fitted with a valve, by which it is closed during the blow.

The results obtained are that, for a consumption of 28 lbs. of tar and 20 lbs. of coke, 1000 cubic feet of a 10 to 12 candle gas can be obtained, having the composition of:

Hydrogen	64·4 per cent.
Methane	12·0 ,, ,,
Unsaturated hydrocarbons	3·0 ,, ,,
Carbon monoxide	15 0 ,, ,,
Nitrogen and carbon dioxide	5·6 ,, ,,
	100 0
Calorific value	400 B.T.U.

The small coke consumption due to the bulk of the water gas being made from the carbon of the tar, reduces the price of the gas; and Mr. Tully estimates that it costs 6d. per 1000 cubic feet. It is quite clear that such an apparatus, using up the surplus tar and coke in a small works, would be a valuable adjunct.

From this rapid review of the processes which are available for increasing the volume of gas obtainable from coal so as to most economically obtain a large volume of a good quality heating gas, and at the same time to utilize to the full the illuminating value of such hydrocarbons as can be obtained from coal, it is clear that considerable economies can be effected, as in a large works, where the blue water gas could be made at from 4½d. to 5d. per 1000 cubic feet, it would be possible to put a 14-candle gas, with a calorific value of 500 B.T.U. or a little over, into the holder at a cost of not much more than 9d. per 1000 cubic feet, as against 1s. per 1000 cubic feet, which we may take it now costs in large works to make a 16-candle power gas in the holder; so that an economy of about 2½d. per 1000 cubic feet would be arrived at in this way. But while strongly urging the importance of reducing the sale price of the gas to the consumer to the lowest possible point, it cannot be too strongly insisted upon that the main cost of the gas is not to be found in the retort-house, and that therefore the economy to be effected in this direction can only be but limited; the chief items which swell the cost of the coal gas to the consumer being charges on the enormous amount of capital sunk in mains and plant and the distributing charges, which cannot be avoided.

In considering the question of the illuminating calorific value of the gas, it must be apparent to everyone who has studied the question that no definite relation can exist between them. One may take a dozen samples of illuminating gas of the same candle power, each of which shall differ from the others in its composition; and as the calorific value is entirely dependent on this factor, it will often be found that two 16-candle gases vary in calorific value to a greater extent than between a 16 and a 15 candle power gas more nearly equal in composition. The following table, however, gives a good idea of the general run of values:—

Relation of Illuminating Value and Calorific Value.

Illuminating Value Obtained by Burning to a 16-Candle Flame and Correcting to 5 Cubic Feet Consumption.	Calorific Value.			
	Calories Per Cubic Foot.		British Thermal Units.	
	Gross.	Net.	Gross.	Net.
11·8	129·6	115·7	518·4	462·8
12·0	129·1	116·7	516·4	466·8
12·0	136·8	123·2	547·2	492·8
12·4	134·2	120·4	536·8	481·6
12·8	135·6	122·8	542·4	491·2
14·0	136·1	121·8	544·4	487·2
14·6	150·9	135·3	603·6	541·2
15·1	149·9	134·6	599·6	538·4
15·3	154·4	138·9	617·6	575·6
15·3	158·0	142·0	632·0	568·0
16·0	158·0	142·6	632·0	570·4
16·0	159·9	143·8	639·6	575·2
16·1	158·3	142·1	633·2	568·4
16·8	160·6	144·7	642·4	578·8
16·8	167·6	151·0	670·4	604·0
17·0	163·6	147·0	654·4	588·0
17·4	162·6	146·1	650·4	584·4
17·2	168·2	151·6	672·8	616·4
17·6	172·0	155·3	688·0	621·2

One of the most important points that have to be definitely settled is the method which shall be adopted in testing the illuminating value of low-grade gas—*i.e.*, gas having an illuminating value of from 15 to 10 candles. The Gas Referees have provided a well-nigh perfect photometric method for testing gas of an illuminating value of 16 candles, and one which gives satisfaction alike to the gas companies and to the authorities whose duties it is to see that the gas companies fulfil their parliamentary requirements; but with reduction in the standard of illumination, the "London" argand, which is the standard burner for the consumption of 16-candle power gas, must, in order to develop the proper illumination from the lower value of gas, be used under the conditions for which it was constructed, as otherwise a grave injustice is done to the gas, and friction is sure to arise. It is clearly recognized by every one who has had practical experience in the testing of burners that the chief factor in developing the true illuminating power of the gas is that the air supply, while sufficient to prevent the escape of any unburnt gas or products, should not be fed to the flame in too large a proportion, as otherwise combustion is completed before the separation and incandescence of some of the carbon particles has had time to add its iota of luminosity to the flame, and the illuminating power is in consequence reduced.

Now, the "London" argand was devised by Mr. William Sugg to develop the maximum luminosity supposed to be possible from a gas of between 16 and 17 candle power; and the air supply to the flame, as regulated by the openings at the bottom of the burner, was so adjusted as to give just the necessary amount of air for this quality. As any fall in candle power means a reduction in the quantity of air necessary for the development of the maximum amount of light, a fall in candle power to 15·5 candles causes an over-aeration, and so accentuates the loss of illuminating value. This was recognized by the Gas Referees, who, in introducing the table photometer, altered the rate at which the gas was burnt at the standard burner from 5 cubic feet per hour to such a rate as would give a light of 16 candles—the recorded illuminating value being calculated from the rate of combustion; so that if a gas of less than 16-candle value were burnt, the increased quantity of gas consumed should balance the excess of air supplied to the burner.

I have made many experiments to determine the influence of the various ways in which the standard "London" argand could be used in testing illuminating value; and for all practical purposes these are four in number:

(1.)—To burn the gas as in the old methods of photometry at a fixed rate of 5 cubic feet per hour.

(2.)—To supply gas to the burner until the flame has a value of 16 candles, and then to take the rate of flow necessary to produce this light and calculate back what the illuminating value of 5 cubic feet would be.

(3.)—To burn the flame at a fixed height of 3 inches, which was the size given by a 16-candle coal gas burning at the rate of 5 cubic feet per hour, and arrive at the true illuminating value of the gas from the consumption, as in the second method.

(4.)—To burn the gas at a 16-candle rate, but to fix the burner in a position which would make the light on the photoped equal to 14 candles.

I used to be strongly of opinion that the right way to utilize the "London" argand was always to burn the gas at such a rate as would give a flame of 3 inches in height, as, under these conditions, one would have the air supplied to the burner exactly fulfilling its normal functions—the height of the flame being an indication of the distance which the combustible gases have to travel before they can obtain the volume of air needed for combustion; and many experiments made during the last twenty years have all indicated that, using the burner in this way, the candle power of gases varying from 25 to 12 candles can be satisfactorily determined.

There is one trouble, however, in using this method in practice; and that is that it is very difficult to get an exact determination of the height of the flame. I have found, by a long and very carefully carried out series of experiments, that between 17 and 12 candles the results given by burning the gas to give a flame equal to 16 candles are in such close agreement with those given by burning it with a 3-inch flame, that, for experimental purposes, they are identical; and inasmuch as burning it at the 16-candle rate enables one to use the table photometer as constructed for 16-candle gas testing, it is manifestly better to adopt a system which requires no alteration in the methods prescribed by the Referees. This being so, we can now discuss the relative merits or demerits of testing the gas by consuming it at a 5 cubic feet rate and at the 16-candle rate with correction back for differences in consumption. The fact that these two methods give very divergent results directly the illuminating power falls to 15½ candles is well known; and I think the following experiments show the reason of this divergence. Taking analyses made during these experiments of a 16 and 14 candle gas, the figures are:—

Experiments with 16 and 14 Candle Gas.

	I.		II.
Hydrogen	52·62 per cent.	..	56·95 per cent.
Methane	36·10 ,,	..	29·05 ,,
Ethylene	3·07 ,,	..	4·00 ,,
Benzene	1·00 ,,	..	0·50 ,,
Carbon monoxide	5·52 ,,	..	7·50 ,,
Nitrogen	1·69 ,,	..	2·00 ,,
	100·00	..	100·00
Candle power	16	..	14
Air needed for complete combustion of 5 cubic feet	24·49 cubic feet	..	26·5 cubic feet.

As the air-ways of the "London" argand are constructed on the basis that 5 cubic feet of 16-candle gas require for its combustion 30 cubic feet of air, it is manifest that, with a 14-candle gas of such composition burnt at the rate of 5 cubic feet per hour, 13 per cent. more air than is needed will be supplied to the flame; and the result is at once apparent when the gas is tested for illuminating value at the 5 cubic feet rate.

Gas tested at 16-candle rate	14·0
,, ,, ,, 5 cubic feet rate	11·5

A difference of about 18 per cent.

In this case, the rate of flow had to be increased from 5 to 5·7 cubic feet to obtain the 16-candle power flame, an increase in gas of 14 per cent, which, by utilizing the excess of air to the best advantage, brings the illuminating value up to the standard which would have been given by a burner specially constructed for its combustion.

The wide divergence in the illuminating value ascribed to the flame of gaseous mixtures of varying quality is shown in the following table:—

Illuminating Power 5 cubic feet rate. Corrected.	16-Candle Flame Corrected to 5 cubic feet Rate.	Volume of Gas Required to Yield 16-Candle Flame.	Illuminating Power 5 cubic feet rate. Corrected.	16-Candle Flame Corrected to 5 cubic feet Rate.	Volume of Gas Required to Yield 16-Candle Flame.
Candles.	Candles.	Cubic Feet.	Candles.	Candles.	Cubic Feet.
6·7	11·3	7·03	14·2	15·3	5·23
7·8	12·0	6·66	14·5	15·6	5·12
7·9	12·3	6·54	15·5	16·0	5·00
8·0	12·4	6·45	15·6	16·1	4·97
8·2	12·4	6·45	15·6	15·7	5·09
9·7	12·8	6·25	15·9	15·9	5·03
10·7	13·5	5·92	16·2	16·4	4·87
11·5	14·0	5·71	16·8	16·8	4·76
12·3	14·6	5·48	17·0	17·0	4·70
13·5	15·1	5·30	17·5	17·4	4·60
13·7	15·3	5·23	17·7	17·6	4·54

It is seen from this table that, for values between 17 and 15·9 candles, it is immaterial as regards results whether the gas be tested at the 5 cubic feet rate, at a 16-candle flame, or a 3-inch flame; the value recorded being the same in each case. But directly the illuminating value falls below the lower limit, the 5-cubic foot rate of consumption at once begins to record an ever increasing falling off in value as compared with that shown by the 16-candle flame standard; this being due to improper regulation of the air supply to the burner, when the lower qualities of gas come to be burnt at a 5-cubic feet rate. The only objection to burning the gas at a 16-candle rate and fixing the burner so much further from the photoped as to throw a light on it of 14 candles, is that it seems unnecessary when the one correction will do all that is required. The one point which is essential in using the "London" argand is that it should be employed under the conditions for which it was made—that is, with a 16-candle power flame, or a flame 3 inches in height.

The duty of prescribing what shall be the standard burner rests with the Gas Referees; and they being gentlemen of the highest scientific attainments and capability, the matter can be left entirely in their hands. But I should imagine that, in view of the divided opinion which exists as to the fitness of the "London" argand as a standard burner for qualities of gas below 16 candles, and the question that arises as to the way in which it should be burnt, they will in all probability prescribe another form of burner better adapted for the quality of the gas that is to be tested. It is always of interest in a case of this kind to note the causes that led to the adoption of the existing standard, and the intentions of Parliament in forming the statutes which refer to it. The holding of the scales of justice betwixt the gas consumer and the Gas Companies had its origin, like many other good works, with the Corporation of the City of London, as it was their Special Act—The City of London Gas Act of 1868—that created Gas Referees and a Chief Gas Examiner for the Metropolis; and in procuring that Act, their whole desire was to obtain absolute fairness both to the manufacturer and the public.

In the various discussions taking place in the Committees of the Corporation on the subject of gas supply prior to the passing of this Act is to be found the history of the introduction of the "London" argand as the standard burner. It was in Dec., 1864, that my predecessor, Dr. Letheby, made a report on the gas supply in the City of London to the Special Committee appointed to consider the question; and from that report I take the following paragraph:—

Since the month of February of this year, the gas of all the Companies has been tested with a burner which raises the illuminating power about 12 per cent. over that of the old burner. The construction of the burner is strictly in accordance with the provisions of the Act of Parliament; and your officer has adopted it, after much consideration, because he has felt that, although the change from the old burner to the new is seemingly against the interest of the public, yet, if any question were to arise in a Court of Law, concerning the defective power of the gas, it would, undoubtedly, be said by the Companies that justice had not been done to them in the manner of testing, for, as no burner can *produce* light, but merely *educe* it, they are entitled to all the light that can be evolved from the gas by any burner which fulfils the conditions of the Act of Parliament.

It was in view of this that when the 1868 Act was passed and the Gas Referees were created and their power defined, their clear duty with regard to the burner to be used for testing was laid down in paragraph 43: "The Gas Referees shall prescribe the burner for testing the illuminating power of the gas; and it shall be such as shall be the most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer." It is abundantly clear from this that the "London" argand was made the testing burner because it was the one which did fullest justice to the gas at that period, and was at the same time one which the gas consumer could utilize if he thought fit. The conditions under which gas is consumed in developing the illuminating power are now better understood; and the Gas Referees would manifestly be quite within their powers, in the case of new Acts lowering the candle power of the gas below 16 candles, in prescribing a different standard burner.

It is perfectly well known that the poorer the quality of the gas the lower must be the pressure at which it is supplied to the flame, and the thicker must be the layer of gas presented to the air; the air at the same time supplied to the flame being, in the case of the argand burner, reduced in quantity so as not to overburn the hydrocarbons. The form of argand burner made by Mr. Sugg, and known as the "Wandsworth" argand, is one which undoubtedly fulfils these requirements. It is a 15-hole argand, in which trapezoidal, instead of circular, holes are employed for the admission of the gas, and in which the pressure is reduced from about 3-10ths (as used in the "London" argand) to a little over 1-10th; while the air supplied to the centre of the flame is reduced to the required amount by the introduction of a rod which contracts its area. I have made a long series of experiments with various qualities of gas with the "Wandsworth" argand and the "London" argand, and find that when the latter, supplied with gas at a rate to yield a 16-candle flame, shows, on correction for flow of gas, that the illuminating value is between 13·5 and 14·5 candles, the "Wandsworth" argand gives the same results with gas consumed at the 5-cubic feet rate; but directly the gas becomes poorer than 13·5 candles, the "Wandsworth" argand, at the 5-cubic feet rate, begins to show the same destruction of illuminating value that the "London" argand, used at the 5-cubic feet rate, does below 15·5 candles.

If the supply of a low-grade gas of the character demanded by the needs of the future is to bear its proper economical value to the consumer, it is clear that, in defining the quality of the gas, a

new burner of this description must be adopted for each quality of gas if the 5 cubic feet rate is to be retained; and if it is desired to keep the "London" argand as a monument of the past, it must be used in such a way as to do the fullest justice that it can to the gas. But I also think the time has now arrived when, in devising the Parliamentary requirements, a standard of calorific value should also be introduced.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The Winter Meeting of this Association was held last Saturday, in the Geological Society's Rooms, Burlington House, W. The PRESIDENT (Mr. Frederick Griffith, M.Inst.C.E., of Leicester), was in the chair; and there was a very fair attendance.

The PRESIDENT, having given the members a hearty welcome, called upon

The SECRETARY (Mr. Percy Griffith) to read the minutes of the annual meeting held at Leicester in July last. This he did; and they were at once confirmed.

ELECTION OF OFFICE-BEARERS AND NEW MEMBERS.

Messrs. Harold J. Winton and Chapman were then appointed Scrutineers of the balloting-papers for the election of officers and new members for the ensuing year. Subsequently, they reported that the following gentlemen had been selected for office:—

President.—Mr. R. H. Swindlehurst, of Bolton.

Vice-Presidents.—Mr. F. J. Bancroft, of Hull; and Mr. E. A. B. Woodward, of Wolverhampton.

Ordinary Members of Council.—Mr. C. Gilby, of Bath; Mr. P. H. Palmer, of Hastings; Mr. James Deas, of Warrington; Mr. H. Ashton Hill, of Birmingham; Mr. C. Sainty, of Windsor; Mr. W. Millhouse, of Scarborough; Mr. C. E. Jones, of Leyton; Mr. H. W. Pearson, of Bristol; Mr. W. Ingham, of Torquay; and Mr. T. Bower, of West Hartlepool.

Hon. Secretary and Treasurer.—Mr. W. G. Peirce, of Richmond.

The following gentlemen were admitted to membership:—

Members.—Mr. H. E. Bellamy, of Rockhampton (Queensland); Mr. E. Hall, of Carnarvon; Mr. H. V. Maclennan, of Kimberley; Mr. W. F. Malloch, of Uitenhage (Cape Colony); Mr. W. H. Maxwell, of Tunbridge Wells; Mr. D. Rankine, of Leamington; and Mr. H. J. Weaver, of King's Lynn.

Associates.—Mr. G. O. H. Klopp, of London; Mr. S. J. T. Smith, of Devonport.

PAPERS AND DISCUSSIONS.

The greater part of the sitting was occupied by the reading and discussion of three papers. The first was by Mr. W. H. HUMPHRYS (York) on "The Coating of Cast-Iron Water-Pipes;" the second, by Mr. T. MOLYNEUX (Stockport) on "The Softening Plant at the Wilmslow Station of the Stockport Corporation Water-Works;" and the third by Mr. JOHN SHAW (Boston) on "The Detection and Prevention of Underground Pollution." The principal features of the papers and the discussions will appear in succeeding issues of the "JOURNAL."

At the close of the discussions,

The PRESIDENT said this brought them to the end of a very successful winter meeting; and he congratulated the members upon the result of the discussions. The papers had been interesting and practical; and they had brought to their notice matters that were of everyday occurrence and of importance in their work. It was his duty to propose a vote of thanks to the readers of the papers for their kindness in preparing them.

Mr. SWINDLEHURST seconded the motion, which was heartily agreed to.

AN INVITATION FROM BOLTON.

Mr. F. A. THOMPSON (Chairman of the Water-Works Committee of the Bolton Corporation) said the meeting had been a very interesting one to him. The subjects that had been brought forward for discussion had appealed not only to water-works engineers, but to outsiders as well. As Chairman of the Bolton Water Committee, he appreciated them very much indeed. He understood that Mr. Swindlehurst was to be the President of the Association next year; and he should like to congratulate him—as a friend, as a ratepayer of Bolton, and as Chairman of the Water-Works Committee. They would all be very proud indeed when he had attained to the eminent position of President; and every member of the Bolton Water Committee would be glad to know of his election. On behalf of the Committee, he (Mr. Thompson) wished to ask the Association to hold their next annual meeting at Bolton; and he could promise they would do their part to make the occasion as interesting as possible.

The PRESIDENT heartily thanked Mr. Thompson for the kindly invitation he, on behalf of his Committee and Mr. Swindlehurst, had extended to the Association. He might at once say that the members would have very great pleasure in accepting it.

Mr. SWINDLEHURST thanked the President, and at the same time acknowledged the honour conferred upon him by his election as President.

The President and Council of the Geological Society having been thanked for the use of their rooms, the proceedings were adjourned to the summer meeting at Bolton.

WHY MILWAUKEE DID NOT BUILD INCLINES.

The paper bearing the above title which Mr. R. B. Brown, of Milwaukee, read before the American Gaslight Association on Oct. 16, and of which we printed the text in the "JOURNAL" for the 4th ult., appears to have given rise to a large amount of controversy at the meeting, judging from the report of the discussion published in the last number to hand of the "American Gaslight Journal." This report, which is described as a "limited abstract," we reprint to-day, together with a copy of a letter, which Mr. Frederic Egner forwarded to our American contemporary, giving certain explanations "in fairness to some of those whose names are mentioned" in the discussion.

Mr. EGNER declared he could not agree with the opening statement in the paper, that the question of inclines *v.* horizontals had been discussed with much acerbity. He had probably travelled more than any other member in his efforts to find out all about inclined retorts. The discussions he had heard on the subject had always been good natured, with one exception, and that had been at a meeting of one of the English Associations, at which Mr. Herring, the Engineer to the Edinburgh and Leith Corporations, and formerly of Huddersfield, tried to induce the advocates of stoking machinery to give facts which could be compared with the facts as to inclines; but Mr. Herring, when in the middle of his remarks, was discourteously stopped by the Secretary of the Association. At a later session, however, Mr. Herring was given an opportunity to finish his presentation of the subject. He (Mr. Egner) said he had endeavoured to get those who favoured stoking machines to give facts which could be compared with those which the advocates of inclined retorts were always ready to give, but had always been unsuccessful in that respect, for the advocates of stoking machinery would dodge the issue every time. The paper presented by Mr. Brown was one of the best arguments he had heard presented on that side—some inaccuracies of figures excepted. A statement was published in the "JOURNAL OF GAS LIGHTING" for March 4 last, showing that in England 77 gas-works were now using inclined retorts; employing 8199 retorts, and making 107,750,000 cubic feet of gas per day. This statement would seem to indicate there was not very much opposition in England to the use of inclined retorts. On the Continent, there were about the same number of inclined retorts in operation; and their use was rapidly increasing. At the last meeting of the German Association of Gas and Water Engineers, at which the paper of Herr Emil Merz, of Cassel, was read (and from which Mr. Brown had quoted), Herr Leybold, the Acting Chairman of the Association, and Manager of the large gas plant at Hamburg, Germany, said:

> It is well known that for years efforts to reduce the labour in the retort-house have been made, which was not only evidently very hard work, but was not altogether free from objection in a hygienic view; and the aim was to simplify and reduce the cost of it as well. Consequently, it was to be regarded as an important innovation when the Superintendent of the Rheims Gas-Works, M. Coze, resolved to introduce the inclined retort system there for the manufacture of gas. The progress of that then innovation has been such as could not have been imagined at that time. It is a matter of course that such an arrangement is not evolved perfect and complete immediately from the brain of the inventor, but that it has to pass through a certain period of development before it reaches perfection, as seen at this date. From the small retort-house, in which M. Coze erected his first bench, there have now sprung an immense number of such works—of course, always in progressive improvement and increasing perfection. These retort-benches (inclines) as they are now built, for example, and as they may be seen at the new gas-works at Mariendorf, near Berlin, where they have been in operation for a considerable time, have thoroughly demonstrated their utility; and we shall all be pleased, if additional experiences with such inclines that you may have gathered would be now communicated, and aid us in having a lively discussion. Of course, benches of inclined retorts are not everything. You have heard in Herr Merz's paper that apparatus for transporting the coal and coke go with it; and methods of bringing the raw material into the house, and the glowing coke out of it, form an important part of the whole. Consequently, the entire saving is not due alone to the inclined retorts, but also the great saving in manual labour brought about by the various conveyors is an important portion of it. I thank Herr Merz for his clear and enlightening paper, and now ask you to enter upon a thorough discussion of the subject.

The views of the members of that Association, as expressed in the discussion of Herr Merz's paper, were without exception in favour of inclined retorts. It was hardly to be supposed that men like Mr. Herring, Herr Leybold, and Mr. Husband, Chief Engineer of the Brentford Gas Company, would make the mistakes implied in Mr. Brown's paper. At Brentford, where 5 million cubic feet of gas was made per day, all the horizontals had been displaced by inclines. At Granton, near Edinburgh, in a magnificent retort-house just completed, only inclined retorts were placed. In two of the three gas-works at Leeds, England, inclined retorts were used. Mr. Townley, the Manager of the Leeds works, stated last May that they were about to enlarge the plant, and to build additional retort-houses in which they proposed to put in inclined retorts. As to the cost of making coal gas in the inclined retorts, Mr. Egner stated that he had been shown a report, made to the Chief Engineer of the Gaslight and

Coke Company, of London, in which was stated in detail the cost of making coal gas by manual labour, by inclined retorts, and by stoking machinery; also the cost of making water gas, or a combination of the three. This report showed that, at the works where inclined retorts were used, the gas cost 2d. less per 1000 cubic feet than at either of the other works. He had also seen a paper, prepared by Mr. Goulden, the Deputy Chief Engineer of the same works, in which the relative cost of erection, results to be expected, and cost of making gas by the different systems were carefully stated in great detail. The conclusion arrived at by Mr. Goulden was that, counting everything, including the higher cost of machinery and building for inclines, they would carbonize a ton of coal at a little over 2d. less by the use of inclined retorts than could be done by any other method. As showing the working and results obtained by the use of inclined retorts at the Crystal Palace Gas Company, Mr. Egner read the following extract from a statement made by Mr. Sydney Y. Shoubridge, the Engineer of that Company, dated May 23, 1902:

The conditions of working the ten settings of inclined retorts at the above gas-works are as follows: In each setting there are two primary air-boxes, 3 inches wide by 2 inches deep, 12 square inches area of opening, two secondary air-boxes on furnace side, 3 inches wide by 1⅝ inch opening, two secondary air boxes on opposite side, 3 inches wide by 1⅝ inch opening—equals 19¼ square inches total area of secondary air openings; four damper openings, 22 inches square when fully open, four 12 inches wide by 1⅜ inch opening—equals 66 square inches. The main flue, tested by Jensen's flutometer gauge, gives a draught of 16 mm. taken at the chimney and with main damper fully open. The main damper is closed down to 3 inches from the bottom of the flue at 8 o'clock Sunday mornings, and is opened fully again at 8 o'clock in the evening. The retorts are not charged from 6 a.m. to 10 p.m. on Sundays. The chimney is 70 ft. high by 4 ft. 9 in. square at the bottom, tapering to 4 ft. 1 in. square at the top, inside measurements. The retorts are charged with 6¼ cwt. of coal every 6 hours. The fuel used for the furnaces equals 15 per cent. of the coal carbonized. The furnaces are clinkered once every twelve hours, and fired up every four hours. At the top of the setting on the discharging side, a pull of 6 mm. is recorded. The seal in the hydraulic main equals 2¼ inches, less vacuum registered, equals 2 inches, and gives the dip-pipes a seal of ¼ inch. The tar is run out of the hydraulic main tar-cylinders every eight hours; the liquor being run into the hydraulic main at the same time at equal rate, so as to maintain the seal of the dip-pipes. The number of men employed is as follows:

2 men on charging floor,	working	8	hours	a day,	at 6s.	per day.
2 ,, drawing	,,	8	,,	,,	6s.	,,
2 barrow men	,,	8	,,	,,	5s. 3d.	,,
2 firemen (clinkering, &c.)	,,	12	,,	,,	7s.	,,

It should be noted that the rates of wages are somewhat higher than those usually paid in the London district; also, it would be quite possible to work five extra settings with the same number of men. An average of a number of tests of the spent gases at the outlet of the settings shows: CO_2, 15·6 per cent.; O_2, 3 per cent.; and CO, *nil*. And of the producer gases: CO, 23 per cent.; O_2, 0·04 per cent.; CO_2, 2·8 per cent.

Note.—Great care should be taken in drying the brickwork in new settings and benches. This should be done gradually. At least two months' drying should be given; more if possible. In heating up the setting, care must be taken not to close the firing door of the generator until the nostril bricks of the arch over the generator are *red hot*, so as to ignite the carbonic oxide gas as it issues from the generator into the combustion chamber. This is *most important;* for otherwise there would be *an explosion in the setting*.

Mr. Littlehales said that thirty years ago he had been Manager of a gas-works in England, since which time he had closely followed the workings of the English gas companies. It seemed to him rather remarkable that when the system of inclined retorts was being discussed the results obtained by Mr. Herring at Edinburgh did not by any means prove, in dollars and cents, the value of the inclined retorts; for it was shown by "Field's Analysis" for 1900 that 23 out of 35 of the principal British companies put gas in the holder cheaper than was done at Edinburgh. The best possible comparison was between Edinburgh and Glasgow, which works were but a few miles apart, and operated under practically the same conditions, although in Glasgow coal cost 34·32 cents per 1000 cubic feet, and in Edinburgh 31·50 cents. In Glasgow, 17·06 cents was returned in residuals; in Edinburgh, 11·10 cents. The cost of gas in the holder at Glasgow was 38·84 cents; in Edinburgh, 39 cents. These were the results obtained by two neighbours, working side by side, the Manager of one being the apostle of the inclined retort, the other using the horizontal; yet in the latter place they were 7 cents per 1000 cubic feet to the good. In Sheffield, gas was put in the holder at a cost of 22·60 cents, as against 39 cents at Edinburgh. Comparing Edinburgh and Glasgow, the latter certainly had the advantage; and if inclines were as good as claimed, this should be reversed.

Mr. Carroll Miller regretted that in some cases Mr. Brown had assumed the figures given, and that in other cases he had not stated practical results. He thought the number of men assumed on the inclined relation to be rather high. He would like to ask Mr. Brown if any of the results stated by him were obtained from practical operation in gas-works. The figures given by Mr. Egner also seemed theoretical; and he would like that Mr. Egner should, if possible, give a comprehensive comparison of figures obtained from actual working results, and not from theoretical proposings, in order to show from such comparison the relative cost of coal and labour in the operation of horizontal and inclined retorts.

Mr. Egner replied that he intended to give only practical and not theoretical results, and had made no comparative statements at this time. Some years ago, he read a paper before the Association in which he had given a comparison of figures obtained from actual working results; but he could not now recall them.

Mr. Doty said that investigation in Detroit confirmed the conclusions reached at Milwaukee. As the result, Detroit was now building vertical retorts, with stoking machinery. He thought the construction cost as given by Mr. Brown was not understated.

Mr. Prichard called attention to the fact that all the figures given, as well as all the remarks made so far, related only to large works making about 4 million cubic feet per day. In works making only 1 million cubic feet per day, part of which was water gas, or works making only half-a-million feet per day, inclined retorts must be used to effect any reduction in the retort-house labour. Starting with the fact that works of the size indicated could use inclines to advantage, and could not use stoking machinery, they could draw two curves, very far apart at this point, but gradually approaching as the size of plant was increased. Whether they approached close enough to touch, or whether they crossed, as Mr. Brown claimed, was open to discussion and to experience. Mr. Brown's paper contained a number of statements with which he (Mr. Prichard) did not care to agree. The author had quoted the make of a bench of inclined eights as 135,000 feet per day; but the guarantees now being put out by responsible builders of inclined retorts were very much more than that amount. In another statement by Mr. Brown, only half the benches were working; yet the same amount for depreciation was charged as if the full number of benches were in duty. To this he took exception. Mr. Brown stated that inclined retorts used an excessive amount of fuel; but he saw no reason why an inclined bench of eights should use more fuel than a horizontal bench of eights. He (Mr. Prichard) did not think that inclined retorts were any more expensive to erect, figuring on the same capacity, as indicated by the figures quoted by Mr. Brown in Table B. Nor were inclines more difficult to repair. The furnaces and arches being the same as with horizontals, there could be no more difficulty in repairing these parts of the one than of the other. The only difficulty came in the middle joint of the inclined retort, and this should not be a very serious matter. In case of a breakdown in machinery, he thought the works would be just as badly off with horizontals as with inclines. He did not agree with Mr. Brown's statements that inclines gave a lower yield of gas per ton; that they depreciated the illuminating power; that they were uncertain in producing capacity; or that they were more trying to the workmen than were horizontals.

Mr. Doty said in his statement that he thought Mr. Brown's figures as to cost were not understated, he meant to say that those figures were not higher than were warranted by the actual facts. The benches in Detroit would cost slightly less than the figures named by Mr. Brown; and the American stoking machinery there cost slightly less than the stoking machines adopted by Mr. Brown.

Mr. Allen S. Miller commented on the fact that Mr. Brown had charged up 24,000 square feet of real estate at a much higher price than 25,000; and also made one coal-bin cost more than twice as much as another one of equal capacity. These might be due to local conditions, but would not usually obtain in practice. Mr. Brown had taken the yield per foot of the inclined retorts as given by foreign works, and compared it with the yield per foot of the horizontal retorts as obtained in American works. There was no reason why as much gas could not be made per foot with inclined retorts as with horizontals; and on this assumption, Mr. Brown's own figures would show that it was very much cheaper to operate inclined than horizontal retorts.

Mr. A. H. Barret said that Mr. Brown's basis of comparison was probably a new one to many of the members; and a comparison of workings on his basis would have to be made in order to reach a satisfactory conclusion as to the accuracy of the results stated by him. He did not, however, see why there should be much complication about it. At Louisville (Ky.), gangs of four men on a shift drew 216 charges per day. Taking 750-pound charges and 5-hour periods, they would get the labour per ton of coal carbonized.

The Secretary asked Mr. Barret to state the yield of gas per retort at Louisville. The yield per foot might not be as great in inclined as in horizontal retorts; for while theoretically there was no reason why the yield per foot obtained from a retort 18 ins. by 30 ins. and 10 ft. long should not be greater than that obtained from a retort 16 ins. by 26 ins. and 9 ft. long, in practice it did not seem to be greater.

Mr. Barret stated that the yield per inclined retort of the indicated size was about 18,000 cubic feet, which was somewhat less per foot than the yield claimed by some for horizontals.

The Secretary further said he was still on the fence as to the advisability of using inclined retorts. He had not studied the subject thoroughly, and it was very hard to get reliable data. The demand in England at the present time was to get figures for both kinds of works, given on a common basis. A Committee had been appointed by one of the Gas Associations there to devise some form of keeping and stating accounts which would permit accurate comparisons to be made of the cost of carbonizing at different works in the country. A gentleman whose judgment as a coal-gas manufacturer was good, who had visited England frequently, and who had good opportunities for getting information,

had stated the general sentiment among the best engineers in England at the present time to be that, for very large installations, there was practically very little difference between inclined and horizontal retorts—that when worked by good stoking machinery the advantage was possibly in favour of horizontals, but that for works of medium size inclines probably had the advantage. The speaker believed that if a bench of eights in two tiers, four high, could be worked in horizontals, but could not be worked in an inclined setting, then the horizontal would have the advantage at the start. There was no question that a bench of nines or a bench of eights built three wide, if properly built and looked after, could be run with good results. But it was much easier to get good results from a bench with but two tiers of retorts than from one with three vertical tiers; for with only one combustion chamber, room could be got there which could not be had for two without sacrificing space, and a roomy combustion chamber was the main thing to be looked out for in a regenerative setting. Without a roomy combustion chamber, good results could not be obtained.

Mr. H. A. CARPENTER said it seemed to him that the comparison between the relative merits of inclined and horizontal retorts was a very simple one; for if similar quantities were eliminated from either side of the equation, the result would be definite and conclusive. Taking the basis upon which Mr. Barret had given information, there were very few retort-houses, equipped with any kind of stoking machinery, which could not do as well as the results stated by Mr. Barret. When those results were compared with what was done with the best grades of stoking machinery, the comparison became very striking. In the No. 4 retort-house at Beckton, four men charged and drew in twenty-four hours the equivalent of 600 charges, of approximately the same weight as stated by Mr. Barret.

Mr. ROLLIN NORRIS asked for information as to the length of the retorts in the Brooklyn installation, and the yield of gas per twenty-four hours; the length of the retorts mentioned by Mr. Barret; and also the length of the retorts on which Mr. Brown based his figures at Milwaukee.

Mr. NETTLETON said that, as he understood the conditions, the inference which had been drawn in the comparison between the works at Edinburgh and at Glasgow, in favour of machine-stoked, horizontal retorts, as against inclined retorts, was not warranted by the facts. While Mr. Herring firmly believed in inclined retorts, and was now putting up what is probably the largest retort-house in the world containing inclined retorts, which he hoped would have a daily capacity of 10 million feet, yet at the time of Mr. Nettleton's visit in 1890 he had in operation only two small benches of inclines; and it was from the results obtained from those two benches, after experimenting with them for over a year, that he determined the form for the inclined settings and furnaces in the new retort-house. So that, in the comparison between Glasgow and Edinburgh, it was machinery in Glasgow, but it was not inclines in Edinburgh. While abroad, Mr. Nettleton had visited a great many gas-works, and came away with the impression that both systems were very good. Each system had its advantages and its disadvantages; but he was impressed by the fact that, in the actual work of hauling the coke out and putting the coal in by machinery, the men were further away from the fires, and their work, so far as the heat was concerned, was much less severe with the stoking machinery than with the inclined retorts.

Mr. BEAL expressed himself as being glad to see that there were in the Association men of radically different temperaments. Some of the members were willing to adopt new sorts of apparatus and to experiment for the benefit of all; whereas others, naturally conservative, were inclined to go ahead slowly. He hoped that, a year hence, after more experience, the advocates of inclined retorts would be able to make a showing as to their value fully as convincing as Mr. Brown's paper had been to the contrary.

Mr. BROWN, in reply, said that he had no excuse to offer, or apology to make, for anything contained in his paper. He was satisfied that results would prove the correctness of his position. He did not agree with Mr. Egner that the fact of use justified the introduction of inclined retorts. He did not think that usage alone justified anything. A man might continue to go along in the same way to cover a mistake; he might be sorry, but not dare say so. Mr. Egner had said that the builders of Continental stations obtained their ideas from such comparisons as Mr. Drory had made; but Mr. Drory's results were of no use for comparison here, for the reason that he had not compared modern installations of the two systems. He would take whatever Mr. Drory had said without question; for he believed every figure he had given was correct, and Mr. Drory's statements condemned inclines. He (Mr. Brown) wished to read the following extract from a letter, dated Aug. 29, received from Mr. Charles Carpenter, of the South Metropolitan Gas Company, of London, who had had as much experience as any other engineer mentioned by Mr. Egner:

> I may say, in reply to your inquiry, that my Company have erected inclined retorts at three of their works—viz., West Greenwich, Old Kent Road, and Bankside. The settings and general arrangement at the former of the works were designed by Mr. J. F. Braidwood; those at the Old Kent Road works by my predecessor, the late Mr. Frank Livesey; and those at Bankside by myself. . . . I may say that the Old Kent Road installation was fitted up with the Shoubridge system of "positive drop" charging appliances. We have had several years' working of inclined retorts, therefore, at different works, and under different engineers, and are now in a position to know something about their merits and demerits. When I tell you that it has been decided by the Board of Directors that the installation at this works, consisting of 150 20-foot retorts, shall be pulled down after having worked next winter, and the house converted to horizontal retorts and machinery, you will understand the direction in which our experience has guided us. Inclined retorts work very well if they can be supplied continuously with coal of the same character as regards its physical condition and qualities—that is to say, one can find out by experience the best arrangement suited to a certain coal; but if the character of this coal is departed from trouble, great waste, and loss ensue. For the present, at any rate, the remaining two installations shall continue; and the reason is that, out of the upwards of nearly 1¼ million tons which we carbonize yearly, we are able to sort out sufficient coal of a suitable character for these two works. But in the case of a large works—like the Old Kent Road—this is impossible. Hence we have decided to "take the bull by the horns," write off our expenditure on inclines, and revert to horizontals. You will ask why we put in inclines in the first place. From what I have seen, and from what I was told, I was very favourably inclined to their use—indeed, the installation at Bankside was put in upon my recommendation. The real difficulty seems to be in getting accurate information. The man who has spent £10,000, £20,000, or £30,000 on an inclined bench is very loth to admit that it is in any degree a failure. I should particularly like you to read the paper which accompanied my description of the Bankside installation, which you will find in the "Transactions of the Institution of Gas Engineers" for 1900, Vol. X., for the reason that all the information I gave then no one can say was biased in the least degree. Within the last twelve months, however, I have been concerned with the patenting of some stoking machinery devices; so that some who may not think with me now consider they have discovered a reason for the opinions I hold. At the time I speak of, nothing of the kind existed in my mind. I have simply turned my thoughts to stoking machinery because I am convinced that therein lies the solution of the economical manufacture of gas from the retort system. Hoping this information may be of service to you in the preparation of your paper, I remain, Yours very truly, Charles Carpenter.

Continuing, Mr. Brown said that although they were building inclines at Leeds, they could not get better results from the new works than they were getting from the old station at Wortley, which had been rebuilt and was now equipped with modern stoking machinery. Mr. Egner had claimed that in some installations the cost of stoking was decreased. The decrease of 2d. per ton in the cost of stoking labour, claimed for some installations, was a mere bagatelle as compared with the fixed charges, maintenance, and depreciation. He had not quite followed Mr. Egner's quotation from Mr. Shoubridge's letter as to the labour account at the Crystal Palace District Gas Company, but believed that the statement showed 50 per cent. more furnace fuel than was needed in a horizontal installation; and Mr. Shoubridge omitted to state any top men or pipe men. Yet it would be surprising if, in his works, one would not occasionally find a gang of men jumping pipes. The notes quoted by Mr. Egner in reference to the Bow Common station must have been very carelessly taken, as he had in his hand a letter from Mr. Goulden, of the Gaslight and Coke Company, stating that Mr. Egner's statements in regard to Bow Common were "incorrect in every particular, as is also that which gives an advantage to the inclined retort system on account of the saving in the up-keep of the settings." Mr. Goulden went on: "The fact is that the verdict of for or against one system or the other must be decided by the consideration of local conditions, and not by the superexcellence of one system over the other." Replying to Mr. Prichard's question as to where the curves would cross as the size of plant was decreased from a 4-million to a 1-million plant, and so on down, or where they would be at zero, he could not agree with Mr. Prichard as to just where the crossing would be, although he might agree with him if he were to figure the size of the plant small enough. He had based his problem on a plant making 8 million feet per day; and he did not know of any installation which was doing more than he had allowed. Taking 135,000 cubic feet per day per bench of eight as the maximum working capacity of the inclines, he could count on getting that, or a little more, at Milwaukee. Taking that figure and simply changing the wage and cost factors for other works, would not change the relative position at all. If the cost of depreciation were greater for inclined than for horizontal retorts, it would make the showing slightly better for the inclines; but the difference was immaterial. The question of heating the vast contents of an inclined bench uniformly, and keeping them at a proper temperature economically, was a very serious one. It could only be done at a large expense for fuel. Replying to Mr. Prichard's suggestion that inclined retorts were no more difficult to repair than were horizontals, Mr. Brown said that one who had tried to repair 10-foot retorts, and had to put patches in the seats of them, might not think it very difficult; but when the retorts were 20 feet long, and inclined at an angle of 32°, and an attempt was made to patch them from below, getting on one's knees to do it, or to patch them from the top and have the hot air and gases come into one's face, it became a little more difficult. As to charging the retorts when the machinery failed, he agreed with Mr. Prichard that if the machinery broke down entirely it would not be possible to charge all the retorts of a 4 million feet per day house by hand. The charging and discharging machinery used with horizontals might break down, and so might the coal handling machinery with inclines. In this country, horizontal machinery

was always provided in duplicate; abroad they did not use spare machinery with inclines. In case of a breakdown with inclines, the retorts could not be fed by hand for two or three days while the machinery was being repaired; with horizontals, it would still be possible to work some of the benches while repairs were being made. The high price paid for real estate, and the expensive coal-bin criticized by Mr. Miller, were due to local conditions, and if these were eliminated from the comparison, the cost as between the two houses would be the same. Regarding the basis of comparison used on the other side, Mr. Brown said that, although Mr. Herring had done excellent work in the direction of uniformity, he had simply figured on obtaining from the inclined retorts just as good work with the same coal as the horizontals were doing, and was putting the labour on the inclined retorts below that of the horizontals. In the construction of the Milwaukee plant, there had been neither time nor money for experiment. It was necessary to start with something that was right; the work had to be done, the Company could not wait for experiment, nor could they afford to put up works of that size as an experiment.

The following is the letter that Mr. Frederic Egner forwarded to the Editors of the "American Gaslight Journal" after the publication of the above discussion:—

Sirs,—In your number of even date, you publish an abstract from the proceedings of the recent meeting of the American Gaslight Association which, in the interest of those of your readers who are not members of said Association, and in fairness to some of those whose names are mentioned, requires further explanation. I hope you will not deny me space to contribute something to it. I now refer particularly to the discussion on Mr. Brown's paper on "Why Milwaukee Did Not Build Inclines," in which connection I am quoted at length.

In the second paragraph of his paper, Mr. Brown raised the question of veracity as to every other writer on inclines and himself; and, as I remarked at the meeting, I hope Mr. Brown did not mean to be understood just the way the thing sounded and reads. But if he did, then that portion of his paper need not be further discussed, but may be left to the cool, sound judgment and past, as well as future, experience of those whom it may concern. Personally, I would consider the said paragraph as beneath my notice. However, in the published abstract of Mr. Brown's reply, there are a few things that must not be passed by without comment, else I would not venture to trouble you with this communication. Then, without quoting from Mr. Brown's words (to save space and time), but with reference to them, permit me to say that, by the courtesy of Mr. G. C. Trewby, Chief Engineer of the Gaslight and Coke Company of London, I visited the Kensal Green works of the said Company, on Wednesday, April 15, and the Bow Lane works of the same Company the following day, of this year.

At the latter of the two works mentioned, I spent considerable time with Mr. J. Wilton, the Resident Engineer, who no doubt because of the lines of introduction given me by his Chief—Mr. Trewby—felt at liberty to show me more attention than otherwise might have been the case. By which I mean to be understood that I would not have been favoured with the details so kindly and freely given to an otherwise stranger. I was shown there a sheet made out weekly in the Chief Engineer's office, and sent to the Superintendents of the nine works of that great (Gaslight and Coke) Company—for comparison's sake, so I was informed; and from this sheet, by permission, I made a few notes. Those which I have given, both at the New Orleans meeting of the Western and the recent meeting of the American Gaslight Associations were that it was shown upon that sheet that gas cost 2d. and a fraction *less per* 1000 *cubic feet made*, with the inclined retorts. About ½d. of this saving was effected by the repairs being less to that amount. They used 2 cwt. of coke per ton of coal carbonized, and sold 10¾ cwt. of coke per ton of coal—so I was informed—at that works. I have given the date of my visit to the Bow Lane works, and the figures, as I copied them, from the sheet mentioned, afterwards confirmed at the Deputy-Chief Engineer's office, to whom I had by that time been kindly introduced by the Chief Engineer. The Deputy-Chief said he would give me a copy of that form which he "himself had devised," but afterwards did not do so.

At my meeting with Mr. Goulden, that gentleman asked me to read, and criticize if I could, a statement he was about to submit "to his Board," in which he had gone exhaustively into the relative cost of gas production by means of stoking-machine-operated and inclined retorts; and which, after giving the first every benefit of figures, still showed that with the inclines the cost would be 2d. less per ton of coal carbonized. And that that was no "bagatelle," was very clearly made plain to me when told the number of tons of coal carbonized annually by the Company. Perhaps I ought not to have made public *any* of the figures given; but I had plainly stated what I was in England for, and expected everyone to understand I wanted those figures for use in advocating inclined retorts. In a number of instances, I pointedly asked if I might publish (or "use") the figures so kindly given me. In the face of the facts as I know and now have stated them, I cannot understand the meaning of Mr. Goulden's alleged statements.

In a recent issue of the patent news in the "Journal of Gas Lighting," &c., I have seen the name "Goulden" mentioned as patentee of improvement to retort stoking machinery; while, according to Mr. Brown's quotation of Mr. Carpenter's letter, the latter frankly admits that he is interested in that way. Let it be noted that I have not dragged Mr. Carpenter's name into the discussion in the first place; and that I never had the slightest information from that gentleman on any subject. But I did mention a reason why one of the works under his charge (as I then learned from the "Journal of Gas Lighting," &c.) was changing from inclined to horizontal retorts. But while I did not contradict an inference at the meeting that this information came from the gentleman named, I will now say that it came from one superior, and whose authority was, and is still, unquestioned to give it. Nevertheless, I will add that the reason given in the letter attributed to Mr. Carpenter in your columns, is about right. But it is not the whole story, which, if told, would exhibit the matter in another and more nearly correct phase. In other words, the truth was told; but not all of it. Consequently, it might have been better had that part of the discussion been left out.

When quoting Mr. Drory—than whom the subscriber has never met a more affable gentleman and accomplished gas engineer, who is justly held in high esteem by the high officials of his Company and by his fellow engineers wherever known—the writer has said that he (Mr. Drory) was the originator and perfector of the inclined retort system as applied by the Stettiner Chamotte Fabric Actien Gesellschaft of Germany, who build most, if not all, the inclined settings in that, and a few in some other countries. Mr. Egner, the subscriber, did not say what is stated he said in your Journal in connection with Mr. Drory. In justice to yourself, I ought to mention here that you simply are quoting, I believe, what Mr. Brown said. But what I did say in connection with Mr. Drory is stated above, and cheerfully left to that gentleman or the manufacturing Company named for confirmation or contradiction. It will be found that "Egner is all right."

In conclusion, let me say once more that "the inclines are here to stay," no matter what Milwaukee may or may not build. It will make little difference; and all the Milwaukees, and what is back of them, cannot keep them out. In the discussion on this paper, both Mr. Brown and Mr. Paul Doty have used the expression "vertical retorts" as descriptive of what is going to be used at Milwaukee. Mr. Brown uses the expression (see his paper) "horizontal full depths (sixes, nines, and vertical eights)"; and although in another part of his paper he gives a brief note on what he means by "vertical eights," the term is misleading. Why not say with reference to the sixes and nines also, vertical sixes and nines? Why use a term descriptive of an entirely different form of retort from horizontals? Why use such a misleading term at all? Vertical retorts, as understand to be, *may* come into use before long. Such retorts have been used for years in the dry distillation of bones and bone black regeneration. They have been tried for coal gas manufacture, but have to date not been a success, though they may become so; and, indeed, there seems to the writer, who has seen drawings of such, that there is a fair probability of such retorts being again tried shortly. Why do Mr. Paul Doty and Mr. Brown use an expression which is misleading as above quoted, and which requires an explanation easily overlooked, and which, if overlooked, would make the reader suppose that Milwaukee really was in the lead with an improvement, which as yet is without foundation?

Morristown, N.J., Nov. 24, 1902. Frederic Egner.

AMERICAN GASLIGHT ASSOCIATION.

Annual Meeting in New York.

The Thirtieth Annual Meeting of the Association was held in New York on the 15th, 16th, and 17th of October, under the guidance of Mr. W. R. Beal, the President. There was a very large addition to the membership; 101 active and 19 associate members being proposed and elected.

The report of the Council recommended a new class of members in addition to honorary, active, and associate members as at present. These would be called "junior members." They must be over 20 years of age, and in the employ of a gas company or a consulting gas engineer, and be qualified, either by experience or education, to hold a responsible position under such employers. Every junior member should pay an entrance fee of £1 1s., exclusive of the subscription for the current year, an annual subscription of 12s. 6d., and be entitled to all privileges of the Association except voting and holding office. Some other modifications of the rules with a view of facilitating the transference from one class of membership to another were proposed, and the report was unanimously adopted. The Treasurer's report showed a satisfactory balance in hand, and the Secretary reported a total membership of 586. The report of the Trustees of the Gas Educational Fund showed steady progress. The second section finished their three years' course on April 1, and a fifth section was started in January, with a membership of 35. The five-year period for which subscriptions were solicited expired next year; but the Committee furnished evidence of the useful position filled by the fund, which they considered would make the renewal of the subscriptions for another five years a matter of course. There were 83 students of all classes, and the Treasurer's report showed an income of £886, and an expenditure of £843; while the invested fund was over £700. Mr. A. C. Humphreys read the report of the Committee on uniform forms of account. Two forms were submitted—one for small and one for larger undertakings. The Committee were requested to prepare these forms last year, and to submit them to the members by post for examination and criticism. They regretted that, having done their part, the membership had rendered but very little assistance. With two exceptions, the work of criticism had been confined entirely to the officials of the United Gas Improvement Company. The Committee recommended that the system of accounts submitted be accepted by the Association as a standard, subject to any modifications that might be suggested by the further replies, and that a complete set should be furnished to each member. After a short discussion, in the course of which the work of the Committee was highly eulogized, the report was adopted. The report of the Research Committee recorded some progress in regard to street-main special castings. Drawings would be submitted for

the inspection of the members within the next few months, and for final approval at the next meeting.

The President then delivered his Inaugural Address, which we have already reproduced (*ante*, p. 1279).

Cement Masonry.

A paper entitled "Some Notes on Cement Masonry" was read by Mr. J. N. Knapp, of Philadelphia (Pa.); and it was a more important production than would be inferred from the title. It extended to considerable length, was illustrated with ten diagrams and five tables, and constituted an exhaustive lecture on the subject. The author commenced by directing attention to the rapidly increasing use of hydraulic cements; the consumption in 1901 throughout the United States being 20½ million barrels. Three kinds were on the market—viz., portland cement, a mixture of finely ground chalk and silicious clay in proper proportions; natural cements, produced from a natural rock, consisting of magnesian limestone containing 20 to 40 per cent. of clay; and slag cements, made by mixing blast-furnace slag and lime in proper proportion. The manufactured portland cement had been so far improved as to reach practical perfection; natural cements were reliable when the material had been competently selected; while slag cements were not very extensively used. The testing of cements was a matter calling for considerable skill and experience quite beyond the average engineer; so it was preferable to depend upon a known brand, rather than on one's own testing, or to get tests from an established authority. The proper manipulation of cements for testing was really an art. Tests for fineness with the aid of a series of sieves were a simpler matter, and were very important, as he knew from experience that particles which would pass a No. 50, but not a No. 70, mesh had no cementing property. It was only the finest or more impalpable dust that was really active; and the finer the cement the larger the quantity of sand that could be used with it. But, of course, a high specification for fineness increased the cost of grinding, and therefore added to the price. Leading manufacturers could readily comply with a stipulation of not more than 1 per cent. on a No. 50 sieve and not more than 10 per cent. on a No. 100 sieve for artificial, and 5 per cent. and 20 per cent. respectively for natural cements. The chief active constituent of all cements was tricalcium silicate, $3CaO, SiO$; and this substance could be discerned by microscopic examination, in the form of colourless cubes. The setting of cement was the initial change from a plastic mass to a friable solid, which took place very rapidly when once started. After being thoroughly set, it was weak and easily pulverized; but then the hardening process commenced, which was slow, and might last for months, if not years, but was greatly hastened at high temperatures. The hardening was due to chemical and physical changes that had as yet defied a complete analysis. Theoretically, a mixture of one part silica to five of chalk should give the maximum hardening properties. Although a sifted cement mixed with three parts of sand was stronger than the unsifted sample, it was a singular fact that the reverse was the case when tested neat, which showed that a test made on a mixture with sand was more important for practical purposes than one on the neat cement. Some experiments were quoted, the results of which illustrated the importance of avoiding excess of water when mixing cement. A great deal also depended on the quality of the sand, which should be clean and not too fine; and it was worth while to pay a good price for the right quality rather than to use a poor sand that might be on the spot and cost nothing. Some serious failures had been traced to the use of a sandy material found in the excavations. Cement should be mixed and used without any re-tempering if uniform good results were expected, as re-tempering after the set had commenced materially weakened the mortar. In his experience, work could be successfully put in during freezing weather, if a brick was used that would rapidly absorb excess of water. It was a mistake to use either the water or the materials in a heated state. The cement might be 40° to 50°, and the brick even colder. A mixture of portland cement with lime mortar was useful for many purposes. The proportion of cement should always be gauged; there should be no guess-work. Mixtures of proportions ranging from 1 of lime paste, 2 of cement, and 10 of sand, to 2 of lime paste, 1 of cement, and 10 of sand could be used according to the nature of the work. Hydraulic lime might be used in place of ordinary; and cement lime mortar deserved wider recognition than it had at present received. In laying a foundation of cement masonry, it was most essential that no water should rise on the work until the cement had thoroughly set. To make good concrete, the components should all be clean and free from dust, and the stone should at least be as hard as the hardened mortar. All material should be accurately gauged, and the exact proportions should depend on the nature of the work. The sand and cement should be mixed dry by turning twice, the stone and gravel thoroughly wetted, and the dry sand and cement added and well mixed—a measured quantity of water being added. A concrete of proper consistency should not quake when wheeled in a barrow, but should quake when heavily rammed into place. In hot weather, it was well to spread a few inches of wet sand over the surface after laying, in order to prevent too rapid drying. A layer 8 inches thick was as much as could be properly rammed. If laid in freezing weather, it should be covered with earth or manure to avoid freezing until the excess of water was gone. Concrete should never be rammed upon soft or sandy ground; but the site should be prepared with broken stones or planking. In ordinary weather, porous brick should be wet, but not soaked; and in cold, freezing weather, it should be used dry. The wetting should be uniform. Gas engineers sometimes complained that gas was not used to the best advantage, and that its quality was blamed when the fault really lay with the appliance through which it was used; and cement makers could say that some of the complaints against cement were really due to poor and improper usage.

Discussion being invited, Mr. A. S. Miller said that, in his experience, it was not safe to rely on the quality of approved brands. One of the best-known qualities had fallen badly this year, owing to the makers undertaking too much, leading to neglect in the selection of the raw material. So all work that could not be replaced, such as a gasholder tank, should be subjected to careful and competent testing. It was also important to see that there was not an excess of magnesia which would lead to cracks and disintegrate after a time. He thought too much was made against excess of water. Perhaps the cement would be stronger without excess; but the use of plenty of water enabled better work to be done, and more than compensated for the loss of strength. It was practically impossible to compact dry cement thoroughly and firmly; and the chances were that many voids would be left either in brick or concrete work. He highly recommended the use of a revolving mixer in preference to hand mixing. Mr. Littlehales remarked that there was such a thing as putting the labels of one maker on the material of another; and therefore it was not safe to rely implicitly on the brand. Mr. Egner said that salt had been found to be advantageous when carrying out cement work in freezing weather. Mr. Woodward thought that with a good machine it was practically possible to obtain more thorough mixture than by any handwork. He had made blocks coloured with venetian red, and the colour showed evenly throughout the block. Mr. Prichard doubted if the machines secured a good mixture, as he had frequently noticed the cement coming out nearly dry. Thorough mixing and ramming were essential to good work. Mr. R. B. Brown had laid a large quantity of concrete, and found a mixer of great advantage, as it could be made to furnish better mixtures than were possible by hand. As to excess of water, he instanced a case where some pits intended to be water-tight, and extending below the bed of a river, were very carefully laid and rammed; but every one proved leaky, showing that all the voids had not been filled. He had, however, occasion to make a pit, and used their concrete poured in but not rammed; and this proved tight under 14 feet head of water. He would like to ask if there was not danger of cement being sent out before it was properly aged? He found the 30-day test was not always the same as the 7 days, and thought this might be due to the cement being sent out immediately after grinding. Mr. Knapp, in replying, said that the presence of an excess of magnesia might be due to insufficient burning. He had tried salt in freezing weather, but found it was not so satisfactory as taking precautions to use the bricks dry and to cover the work. No doubt a good deal of new cement had been sent out. He thought machine must be preferable to hand mixing, and had been told that, with the aid of machinery, the proportion of cement could be brought down to 1 : 12, and that concrete in such proportion was being used on the River Mississippi. With thorough mixing, he believed the quantity of cement could be very considerably reduced. He doubted if any cement work could be made perfectly water-tight without an impervious coating on the side of the pressure.

(*To be continued.*)

Electrolysis Experiments.—According to experiments recently made by Mr. A. Larsen at the Copenhagen Technical College, electrolysis may be diminished by periodical reversal of the current. Several lengths of pipe were buried in the ground with their ends separated, and equal currents were passed through all the pieces. In some of them the direction of the current was maintained uniform; in some it was reversed at hourly intervals; while in others it was reversed every 24 hours. After some time, the pieces of pipe were taken out and weighed. It was found that the loss of weight in the case of the pipes with daily reversal of current was only one-fourth as much as with those pipes in which the direction of the current was maintained constant. Currents of 0·121 to 0·341 ampere were used.

Production and Use of Acetylene Gas.—Since the reading by Professor Lewes, at the Society of Arts, some years ago, of his memorable paper on the production of acetylene gas from carbide of calcium, great advances have been made in the direction of utilizing this gas for lighting purposes; and in response to a desire manifested for a practical work on acetylene engineering, the proprietors of the "Engineering Times" requested Mr. W. Doman to prepare one, to appear in the form of monthly articles in the pages of that periodical. The articles have now been reprinted in book form, and have been issued, under the above title, by Messrs. P. S. King and Son, of Westminster. The author starts with the raw material, and then deals successively with the properties, production, and consumption of acetylene, and the fitting up and care of an installation of plant for its manufacture. In his 60 pages of matter he has brought together a good deal of information which an inquirer into the subject will find useful. The text is illustrated by a number of diagrams and views.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Thursday, Dec. 4.

LONDON WATER (RECOMMITTED) BILL.

The consideration of this Bill by the House in Committee, which was adjourned at the close of the debate on the 18th of July (*ante*, p. 219), was resumed to-day—Mr. A. P. JEFFREYS in the chair.

Mr. E. ROBERTSON asked the Chairman if he would accept a motion to report progress, as he wished to elicit from the Government a statement as to their intentions with regard to the Bill. They were now, after a session of nearly twelve months' duration, asked to take up a long and complicated measure of scarcely less importance than the Bill they had just finished [the Education Bill]. Moreover, it was longer, having 52 clauses and six schedules. It was therefore impossible, at this period, to give proper attention to it.

The CHAIRMAN said he should, under Standing Order 23, refuse such a motion as an abuse of the rules of the House.

The consideration of clauses was then proceeded with.

On clause 1, providing for the establishment of a Water Board,

Mr. GRANT, in the absence of Dr. Macnamara, moved an amendment providing that the members of the Board, other than the Chairman and Vice-Chairman, should be "elected" instead of "appointed" by the constituent authorities.

The amendment was accepted by the President of the Local Government Board (Mr. Long), and agreed to.

The first portion of clause 1, as passed, stands as follows:—

(1) A Board, to be called the Metropolitan Water Board, and in this Act referred to as the Water Board, shall be established for the purpose of acquiring by purchase and of managing and carrying on the undertakings of the Companies mentioned in the first schedule to this Act (in this Act referred to as Metropolitan Water Companies), and generally for the purpose of supplying water within the area described in the second schedule to this Act, subject to such alterations therein as may be made by or under this Act, which area is in this Act referred to as the limits of supply. (2) The Water Board shall be a body corporate with a common seal, having power to acquire and hold land for the purposes of this Act without licence in mortmain. (3) Subject to the provisions of this Act, the Water Board shall consist of a Chairman, a Vice-Chairman, and other members. The Chairman and Vice-Chairman shall, until the time fixed by this Act for the first new appointment of a Chairman and Vice-Chairman, be appointed by the Local Government Board and afterwards,

The following is the remainder of the clause:—

by the Water Board, and the other members shall be appointed by the constituent authorities specified in the third schedule to this Act; and the number of members to be appointed by each such authority shall be that mentioned with respect to that authority in that schedule. (4) The Water Board shall pay to the Chairman and Vice-Chairman such salaries as the Board may determine. (5) Subject to the provisions of this section, the provisions of the fourth schedule to this Act with respect to the constitution and proceedings of the Water Board shall have effect.

Mr. LONG moved to leave out all the words of sub-section 3 after "the other members shall be appointed," in order to insert after "appointed" the following:

Ten by the London County Council; two by the Common Council of the City; two by the Council of each of the Metropolitan Boroughs of Islington, Kensington, Lambeth, St. Pancras, Stepney, and Westminster; one by the Council of each of the other Metropolitan Boroughs; one by the County Council of Essex; two by the Council of the borough of West Ham; one by the Council of the urban district of East Ham; one by the Council of the urban district of Leyton; one by the Council of the urban district of Walthamstow; one by the Councils of the urban districts of Buckhurst Hill, Chingford, Loughton, Waltham Holy Cross, Wanstead, and Woodford; one by the County Council of Kent; one by the Councils of the urban districts of Beckenham, Bromley, Chislehurst, and Penge; one by the Councils of the urban districts of Bexley, Dartford, Erith, and Foots Cray; one by the County Council of Middlesex; one each by the Councils of the urban district of Tottenham and of the urban district of Willesden; one by the Council of the borough of Ealing and the Councils of the urban districts of Acton and Chiswick; one by the Councils of the urban districts of Brentford, Hampton, Hampton Wick, Hanwell, Heston and Isleworth, Sunbury, Teddington, and Twickenham; one by the Councils of the urban districts of Edmonton, Enfield, and Southgate; one by the Councils of the urban districts of Hornsey and Wood Green; one by the County Council of Surrey; one by the Council of the borough of Kingston and the Councils of the urban districts of East and West Molesey, Esher and the Dittons, Ham, and Surbiton; one by the Councils of the urban districts of Barnes, the Maldens and Coombe, and Wimbledon; one by the County Council of Hertfordshire; three by the Conservators of the River Thames; one by the Lea Conservancy Board.

The right honourable gentleman reserved his reason for moving the amendment; explaining that it had been arranged between both sides of the House that the discussion of the constitution of the Water Board should, for convenience, be taken on an amendment standing in the name of the honourable member for Chippenham (Sir J. Dickson-Poynder).

Mr. BUXTON thought it would have been more courteous if the right honourable gentleman had recapitulated some of the arguments he had made in favour of the extraordinary proposal.

Mr. LONG explained that, for the convenience of honourable gentlemen opposite, he had brought the proposal out of the schedule, and put it in the first clause of the Bill, understanding that the debate upon it should take place upon the amendment.

Sir H. CAMPBELL-BANNERMAN thought it would be more convenient if the right honourable gentleman stated the reasons for his scheme, and allowed a general discussion to take place.

Mr. LONG said he would respond at once to the appeal of the right honourable gentleman; but, having made his statement, he could not repeat his reasons in dealing with amendments. He had nothing to add to what he said when the Bill was before the House on the second reading, when he stated that the bodies to whom was given representation had been selected because the Government thought there ought to be on the new body a general representation of all the interests concerned. With the exception of the London County Council, the scheme had found general acceptance among the people of London and of the Metropolitan Boroughs. When he said this five months ago, he was only speaking from general report. But now he knew more, and he said that, if anyone attempted to get up an agitation among the authorities of London against the Bill, it would be foredoomed to failure. It would be impossible to carry out the principle he had adopted and at the same time reduce the number of representatives. He started with the principle that on the new body there should be a majority of London, though not necessarily of the London County Council. The moment people attempted to cut down the representation, they either destroyed the superiority of London on the body or they interfered with the proportion between London and the outside area. London now had a majority on the body under the Government scheme; and there was, it seemed to him, a fair and strict proportion between London and the surrounding districts. He believed the scheme he submitted was the best which could be proposed, and the only practical one which that or any other House would be able to carry into law.

Mr. LOUGH regarded the proposed Board as far too large to do its work properly, and held that it was constituted at variance with the recommendations of Royal Commissions and Committees which had fully inquired into the subject.

Sir G. BARTLEY, while recognizing that London had made up its mind to buy out the Water Companies, thought this action might come to be regretted. It might be recognized in future years that it would have been better to compel the Companies to do their duty under the penalties provided Desiring, as a London member and in the interest of London as a water-consuming district, to see that the body which was to carry on the enormous business of water supply should be efficient, he must candidly say that to his mind the idea of creating a body of 73 members, brought from all parts, to carry on for three years a business involving 50 millions sterling, was not his idea of efficiency. His view was that the financial interests involved rendered it desirable that a very much smaller body, similar to a paid Board, should look after this work. The scheme represented an enormous development of municipal trading, and he looked upon it with misgiving.

Sir J. DICKSON-POYNDER then submitted, as an alternative proposal, that the Water Board should consist of 33 members, apportioned as follows: The London County Council, 14; the Common Council of the City, 2; the County Council of Essex, 2; the Council of the borough of West Ham, 2; the County Council of Kent, 3; the County Council of Middlesex, 4; the County Council of Surrey, 3; the County Council of Hertfordshire, 1; the Conservators of the River Thames, 1; and the Lea Conservancy Board, 1.

The CHAIRMAN pointed out that the honourable member could not submit his proposal as a whole, inasmuch as it would shut out other amendments.

Sir J. DICKSON-POYNDER said that, under these circumstances, he would proceed in detail, and would propose, first, to substitute 14 for 10 as the number of the London County Council members on the Board. He declared that, from a constitutional point of view, the principle underlying the Government amendment was a thoroughly unsound one. Every Water Commission and Committee had condemned it, including the recent Joint Committee of both Houses. He contended that the County Council representation should be put on the Board, and not that of the Borough Councils. He did not wish to cast any reflection on the borough or urban authorities, but their duties should always be confined to their own areas. The size of the Board was portentous, while the work could and ought to be done by a small body; and he earnestly appealed to the Government to reconsider their proposal in this respect. It was approved of by hardly a soul; and the most businesslike men were opposed to it.

Mr. BURNS contended that Mr. Long had no case, and had not attempted to make any; and he expressed the hope that the Government would not press the clause at this time of the year. He objected to the proposed Board on the ground that it was cumbrous, unwieldy, and inexperienced.

Sir E. VINCENT was altogether unable to comprehend the alarm which was apparently felt at the constitution of a body consisting of 73 members, and still more the enthusiasm which a body of 33 apparently inspired. He submitted that there was no essential difference in the methods of administration of a Water Board of 73 members and one of 33. He believed it would be altogether impossible for the Government to carry through Parliament any proposal which confided the water supply to the London County Council, or to a body in which the Council had a large preponderating interest. The real truth of the matter was that the opposition to the Government's proposal proceeded from those who would be satisfied with no solution but one which left the London County Council in command of the field.

Mr. MELLOR remarked that it was very late in the session to discuss so important a measure as the one before the House. If, however, the right honourable gentleman would accept the amendment, he would get his Bill very easily; and, if necessary, he could bring in an amending Bill next year. Why should the Government force a Board of 73 on London? The Llandaff Commission, of which he was a member, would have preferred the administration of the Water Companies —for which enough had not been said—to that of a board of 73. What was the use of a Royal Commission, if its unanimous recommendations were not to be regarded? He hoped the Government would even now listen to their suggestions, for this was not a political question. Their scheme would result in the borough and county representatives differing from each other; and the system of Progressives and Moderates would be reproduced. It was most desirable to avoid anything in the nature of debating; what was wanted was administration.

Mr. LONG remarked that whatever could be said about the Government proposal, at any rate the amendment before the Committee was not based on the recommendation of the Royal Commission. The Government were asked why they had departed from that recommendation. The reason was because they had to deal with this question as practical men who had to face a practical difficulty. As a

matter of fact, the advice given by Royal Commissions was very seldom taken; their recommendations, unfortunately, were very often put on one side. As to this not being a political question, it was a remarkable circumstance that all those who criticized his proposals and denounced them were occupants of the benches opposite. If the amendment of the honourable member were accepted, though they might be getting rid of one difficulty they would only be raising another difficulty, which would interfere even more seriously with the passing of the Bill. He failed to see why the London County Council should be accredited with every virtue, while every kind of vice was attributed to the Metropolitan Borough Councils. Those Councils would have to find the money—not the London County Council; and, therefore, they should have a fair share of the control. The Government, he maintained, had acted wisely, inasmuch as, in dealing with a sanitary matter, they had taken the local sanitary authorities as the basis of their plan. He did not believe that any other system than the one proposed was practicable or workable; and it had been adopted because it was essential to secure the confidence of the ratepayers and consumers in every part of the water area.

After some further remarks,

Mr. LONG moved the closure, which was carried by 156 votes to 46—a majority of 110.

The Committee then divided on Sir J. Dickson-Poynder's amendment, and it was lost by 48 votes to 153—a majority of 105.

CAPTAIN NORTON then moved an amendment reducing the representation of the City of London on the Water Board to one; but it was negatived.

Mr. LOUGH next moved to reduce the representation of the boroughs of Islington, Kensington, Lambeth, St. Pancras, Stepney, and Westminster from two to one. But he subsequently withdrew it, and proposed another giving all the boroughs named, except Westminster, one member each.

Mr. LONG said the Government felt there was so much difference in regard to the population and rateable value in the case of some of the Metropolitan Boroughs that they ought to be given a larger share of representation. Of course, he fully admitted that there were some boroughs which came very near the line; and he was glad that the representatives of boroughs to which additional members had been allowed had given way. He could not help thinking it would be fairer all round that the boroughs should have equal representation, and this would avoid a difficulty which he confessed had not occurred to him—namely, that however accurate the calculations of the Government might be now, the time must come before very long when they might be entirely upset. In these circumstances, he hoped the larger boroughs would feel that it was to the advantage of the whole that they should concede this.

The amendment was then agreed to; the City of Westminster being excepted from its operation, and left with two representatives.

Mr. BUXTON moved an amendment with the object of grouping the Metropolitan Boroughs for the purposes of representation, and so reducing their total number on the Board. He said the object of the President of the Local Government Board in having the Metropolitan Boroughs represented would still be gained, though, by the system of grouping which he suggested, the number of representatives would be reduced from 34 to 12. If the principle were accepted, he was not desirous of insisting on a particular grouping.

Mr. LONG said the Government thought each Metropolitan Borough entitled to separate representation. Apart from this, the balance of power as between London within and London without on the Board would be seriously disturbed if the amendment were accepted.

Mr. BUXTON explained that he contemplated a consequent reduction in the outside representation to meet the view of the right honourable gentleman.

Mr. LONG said if this were practicable, the amendment would not be open to one portion of his criticism. But he thought the Government had gone as far as they could; and he objected to the amendment as involving the recasting of the whole scheme for the constitution of the Board.

Sir H. CAMPBELL-BANNERMAN thought the Board, as proposed, would be an unwieldy body; and therefore it was desirable to find means to reduce its numbers. He urged the Government to give up their apparently helpless attitude in the matter, and to so arrange the representation that London should have 24 members and the outside authorities 12.

On a division, the amendment was lost by a majority of 93.

Mr. LOUGH moved an amendment to omit from Mr. Long's amendment the representation given to East Ham, Leyton, Walthamstow, Buckhurst Hill, Chingford, Loughton, Waltham Holy Cross, Wanstead, and Woodford, in order to substitute the following: "One by the Councils of the urban districts of Buckhurst Hill, Chingford, East Ham, Leyton, Loughton, Waltham Holy Cross, Wanstead, and Woodford." He held that the representation given by the Bill to Essex was a great deal larger than the county was entitled to.

Mr. LONG opposed the amendment, but undertook to reconsider the question of a reduction of the representation of the outer areas.

The amendment was withdrawn.

Progress was then reported, and the House adjourned.

Friday, Dec. 5.

The Committee resumed the consideration of the Bill to-day—Mr. JEFFREYS in the chair.

Mr. LOUGH moved an amendment with the object of reducing the number of representatives of the county of Essex by one, preserving at the same time, for Walthamstow, representation as an urban area.

Mr. LONG said he could not accept the amendment. The representation on the Water Board was settled by compromise, and this was arrived at after consultation with all the areas concerned.

Dr. MACNAMARA asked for an assurance from the President of the Local Government Board that he would consider the question of the representation of the outer areas, with a view of redressing the balance between London within and London without.

Mr. LONG said he had no hesitation in responding to this practical suggestion. He admitted that the reduction of the members for London within by five altered the proportion as between the two parts of the water area. The question then arose whether they could rearrange the general grouping of the outside areas in such a way as to obtain the release of a certain number of representatives, with a view of giving them to Inner London. He was ready to consider this matter on the understanding that they were now allowed to regard the representation scheme as complete, subject to its revision on the report stage.

Mr. BUXTON said in their opinion the representation of Inner London was considerably below the proportion which it ought to have as compared with Outer London, whether rateable value or population were taken into consideration.

Mr. LONG said he desired to be perfectly frank with the Committee, and would tell them what was in his mind. He thought it would be possible, by some rearrangement of the outside areas, to release (say) four members; and these might be added to the representation of the London County Council, which would bring it up to the number at which it stood in the amendment of Sir J. Dickson-Poynder, and at the same time redress the balance as between London within and London without. But he must ask that the somewhat liberal concession he had indicated should be regarded as a temporary settlement of the scheme of representation.

Sir H. CAMPBELL-BANNERMAN expressed the hope that his friends would recognize the very reasonable spirit which the right honourable gentleman had shown in this matter. He did not wish to say too much of the concession, but, at all events, it was a very great step towards what was being arrived at by the various amendments moved from the Opposition side of the House. There still remained, of course, in their view, the overgrown governing body. But the right honourable gentleman had certainly indicated an arrangement which would meet a good many of the objections to his scheme; and if it was understood that an arrangement of this kind would be considered and proposed, it would avoid the necessity of elaborate arguments and discussions on the scheme of representation.

Mr. Lough's amendment was then withdrawn, and that of Mr. Long agreed to.

Mr. REA moved to omit the sub-section providing that the Water Board should pay the Chairman and the Vice-Chairman such salary as the Board might determine. He asserted that the proposal would add neither to the dignity nor the efficiency of the Board, and that the best precedents were against such a course.

Mr. LONG said that the Government raised no objection to the sub-section being made optional—to the word "may" being substituted for "shall."

Mr. Rea's amendment was withdrawn, and an amendment was agreed to leaving the Water Board a free hand.

After some further discussion,

Mr. LONG expressed the opinion that it would be far better to leave the appointment of the Chairman and Vice-Chairman in the hands of the Water Board instead of the Local Government Board; and he said he proposed to give effect to this on the report stage of the Bill.

On the motion that clause 1, as amended, stand part of the Bill,

Mr. BUXTON objected to the Government pressing forward a Bill of such magnitude and complexity at an advanced stage of the session.

Mr. LONG defended the clause from the attacks made upon it, and reiterated his previous statement that the scheme he had submitted for the settlement of the London Water Question was the only one which had found general acceptance.

After some discussion, the Committee divided, when the clause was adopted by 124 to 40—a majority of 84.

On clause 2, providing for the transference of the Water Companies' undertakings to the Board,

Mr. LOUGH moved to substitute the word "consideration" for "compensation," in sub-section 2, which specifies that "the Water Board shall pay to each Company, as compensation for the transfer of their undertaking, such sum as may be agreed upon, or, in default of agreement, as may be determined by arbitration under this Act."

On a division, the amendment was rejected by a majority of 85.

Mr. LOUGH moved an amendment, the effect of which was to prevent the Board and the Water Companies coming to a private agreement as to the amount of compensation to be given for the undertakings, and compelling the parties to go to an arbitration in each case.

Mr. LONG declined to accept the amendment, and said there was no reason to doubt that the new Board would be men thoroughly competent, and with sufficient experience to deal with this matter.

After some further discussion,

Mr. LONG promised to consider the matter before report, whereupon the amendment was withdrawn.

Clauses 3 and 4 ("Effect of Transfer" and "Security for Mortgage and other Debts Transferred to Board") were then agreed to, and progress was reported.

LEGAL INTELLIGENCE.

ISLE OF WIGHT COUNTY COURT.—Newport, Dec. 3.

(*Before His Honour Judge* GYE.)

Claim for Loss of Gas through Electric Lighting Operations.

To-day his Honour had before him a claim by the Sandown Gas Company for £22 18s. 4d., the price of 110,000 cubic feet of gas, which it was estimated had escaped from their main in the Broadway, Sandown, owing to it being fractured, as they alleged, by a blow from a pickaxe used by a workman in the employ of the Isle of Wight Electric Light Company, when laying a cable in the road in March last year.

Mr. J. MARSH appeared for the plaintiffs; Mr. WILTON represented the defendants.

The evidence submitted in support of the claim was to the effect that

soon after the completion of the work of laying the electric cable, an escape of gas was perceived at the spot in question; and an excavation by the Gas Company's men revealed a fracture covered over with a piece of tarred material, similar to that used by the employees of the Electric Light Company. Thereupon the Gas Company's Engineer and Manager (Mr. H. W. Falkner) wrote to the Electric Light Company calling their attention to the discovery, and asking them to ensure that, in the case of such accidents in future, the Gas Company should be immediately informed thereof, or they would be held liable for the loss of gas. Several months later, it was noticed that shrubs were dying in the vicinity, and another excavation by the Gas Company revealed a second fracture, about 50 yards from the first. No notice had been given of this damage by the Electric Light Company, and consequently it was estimated that the gas had been escaping for some six months in quantities which amounted in the aggregate to a much larger sum than that claimed. The Gas Company sent to the Electric Light Company an account of the damage and loss of gas; and the latter, while paying for the damage to the pipe, repudiated liability for the loss of gas. The amount estimated to have been lost was arrived at by means of tests made with the fractured portion of the pipe at the works of the Newport Gas Company, whose Engineer and Manager (Mr. H. J. Ibbotson) said the estimate was extremely reasonable, as it was possible for 400,000 or 500,000 cubic feet of gas to have escaped during the period in question.

Mr. WILTON said the Electric Light Company paid claims for damages to pipes simply to avoid trouble and friction with the gas companies, whether they did the damage or not. In many cases gas-pipes were in a very dilapidated condition.

His HONOUR remarked that this was extraordinary liberality; but it was a very dangerous precedent.

Mr. WILTON admitted this, but said that, the defendant Company having given the statutory notice of their intention to lay the cables, the plaintiffs should have exercised their powers of superintending the works, and seeing that no damaged gas-pipe was covered in. By their failure in this respect, the Gas Company had shown contributory negligence, which, according to decided cases, precluded them from recovering for loss of gas under such circumstances.

His HONOUR pointed out that Mr. Wilton could not quote any decision supporting his contention. The decisions referred to were given in cases in which passers-by had claimed for damages from a gas company for personal injury; and this was a very different matter.

Mr. WILTON said the defendants were fighting the case on principle, as it affected other companies who had powers to open the roads.

His HONOUR: What about your having paid for the damage to the gas-pipe?

Mr. WILTON: I agree that that is a weak spot in our case.

After hearing evidence of the defendants' officials, who denied all knowledge of the damage, and said it was their invariable custom to report to the companies concerned when mains were damaged,

His HONOUR said he was guided alone by the action of the Electric Light Company in paying for the damaged pipe, in coming to the conclusion that he must give judgment for the plaintiffs. He had come to the conclusion—though, he admitted, not without some doubt, as it was a most difficult case, the evidence being so circumstantial—that the Electric Light Company did the damage, and therefore, as a matter of law, they must pay. The existence of statutory powers did not prevent the Gas Company from recovering against the Electric Light Company for an act of negligence. The nature of the claim was extraordinary, and the amount of the damage claimed could only be a rough estimate; and he therefore thought the justice of the case would be met by his giving judgment for the Gas Company for £15 and costs.

Mr. WILTON asked for leave to appeal.

His HONOUR said Mr. Wilton could submit to him, in writing, any point he thought fit; and if it properly arose, it would be dealt with in the way desired. He thought the law was perfectly clear.

A CLAIM IN THE AUSTRIAN LAW COURTS AGAINST BARON AUER VON WELSBACH.

The following is a translation of a lengthy report in the "Neus Wiener Tagblatt" of Nov. 26, of the hearing in the Commercial Branch of the Vienna Law Courts of an action instituted by Baron Auer von Welsbach, the inventor of the Welsbach incandescent mantle, against a claimant to a share in the profits said to be arising therefrom:—

As we announced in yesterday evening's issue, the inventor of the Auer (Welsbach) light, Dr. Carl Freiherr v. Auer, brought an action before the Commercial Courts against Engineer Bernhard Rund, to establish that the latter has no claims to bring against him. Herr Rund, in February, 1891, had, with a partner, acquired the business rights of the Auer patents, together with future alterations and improvements, for which he paid 20,000 florins, and in return had an interest of 50 per cent. in the profits. In June of the same year, the agreement was cancelled, the firm of Rund received back the 20,000 florins, and Dr. v. Auer the rights on his patents. On August 10, Dr. v. Auer announced his new invention, the improved white Auer (Welsbach) light, which first established Auer's great success. Rund received, when Dr. v. Auer founded the Incandescent Gas-Light Company (Gasglühlicht-Actiengesellschaft), a well-paid post in the same. He then, with the aid of the Company, became independent in Switzerland, and returned to Vienna three years ago. On the occasion of an action for slander which Engineer Rund brought against a Herr Wachsler, he declared that he still had claims on Baron Auer. The result of this declaration was that Baron Auer brought an action against the engineer to establish that such claims did not exist. The proceedings were adjourned in the afternoon, after the Court had admitted a portion of the proofs of evidence, for the purpose of calling witnesses.

In yesterday's proceedings, before Justice of the Supreme Court, Dr. R. Brücke—as we have already reported in detail—Dr. Gallia, as Counsel for the plaintiff, maintained the standpoint that Rund had repeatedly given written declarations in which he clearly admitted that he could neither bring any claims against Baron Auer nor against the Incandescent Gas-Light Company. Counsel for the plaintiff stated that, at the time when Baron Auer was induced, or almost forced, by the firm of Rund to repurchase the patents, he had not yet made his new discovery; and even if he had already been experimenting on it, he would not be obliged to inform Rund thereof. Also the statement that Baron Auer, after the repurchase of the patents, had offered to make Herr Rund a partner, was incorrect. Baron Auer rested his lawful interests upon the immediate settlement of the action, because he was still in the position of having to meet a contingent compensation suit by Rund. Dr. Gallia laid stress on Baron Auer having discovered quite a new mantle, a new process, and a new mixture of thorium and ceria, and that only at a time when the agreement with Rund had already been dissolved. With regard to the evidence of Herr Friedmann in the slander action, according to which Auer's former Secretary, Kuschenitz, had already, prior to February, 1891, shown him in Auer's laboratory the new white incandescent light, the Counsel declared that he had possibly seen one of the many models on which Baron Auer experimented, but that the latter could certainly not make any communication about an invention until it was ready to be patented and put on the market; also Baron Auer had not so much confidence in Rund as to initiate him in things which must then still have been kept secret. Dr. Gallia concluded that there certainly would have been no such case as the present if the new incandescent gas-light had not achieved great success. To the inquiry of the President why the question of limitation was not touched, plaintiff's Counsel declared this had not been followed on moral grounds, as well as because an aspersion of a criminal character had been made on Baron Auer.

Dr. Elbogen then began the answer to the allegation, and devoted thereto a speech of nearly three hours. At the outset, he alluded to the social and material difference in status between the plaintiff and the respondent, and appealed to the Judge for justice. He pointed out that, shortly before the proceedings, the plaintiff had performed a change of front, and extended the charge by placing it upon another basis, evidently because the old position had been shaken. He (Dr. Elbogen) had not made any protest, because he did not wish it to appear that he desired to evade the kernel of the matter through a formality. Dr. Elbogen then went into the merits of the claim, and took up the position that the Engineer Rund really had claims on Baron Auer. If he had earlier signed compulsory declarations to the latter that this was not the case, it was only because he had the impression, but was not certain, that Baron Auer, at a time when it was his duty to impart his epoch-making improvement in the incandescent light, had kept it from him.

Dr. Elbogen quoted the more important conditions of the agreement concluded in the year 1891 between Baron Auer and Rund, and, in the further course of his remarks, stated that the Patent Court in the year 1894 had declared the patent granted to Baron Auer in 1891 void, on the ground that the new mantle did not embrace the qualifications for being the object of an independent patent, and "because the conditions obtaining were already sufficiently protected by earlier patent rights." The new subject for a patent was an allied invention of the mantle already in use, so that novelty must be denied it. According to the agreement quoted, Auer was under obligation to notify every improvement and alteration in his patents to the firm of Rund and Co. "I admit," said the speaker, "that Rund had no right to demand that every phase of the experimental work should be brought to his knowledge; but, on the basis of the agreement, it was Auer's duty to communicate experimental results to Rund without regard to whether these results portended an improvement or a deterioration."

The repurchase of the patents took place without any sacrifice on Auer's part, as he repaid only that amount which he had received a few months before as the purchase price. Rund was not a parasite, whose pursuit was only to exploit the inventor's genius; he was not a vampire, which will have its gratification without working. The claims of Rund also do not rest on the right of equity alone. Rund was the Manager, Auer the inventor. Auer had nothing to risk; Rund risked his resources for work, and his money. The agreement also secured to Rund the rights of a Manager. Point 1 of the impeachment must be dismissed, because experimental results had undoubtedly to be communicated to Rund. With the point of the impeachment which dealt with Rund's claim to be regarded as a partner of Auer's in his undertakings, the defendant's Advocate stated that he would not busy himself further. All respect to Baron Auer, yet he only had the one desire of having the matter arranged as comfortably for himself as possible. He must, however, submit to being treated like any other mortal. All respect for his inventions; but regard for his personal interests must not here cause prejudice.

The essentially difficult point of the case lies, however, in point 2 of the impeachment. Chemistry and technology have very little to do with the course of the action. At the time the agreement was made, Dr. Auer was not to be identified with the Baron Auer of the present day. Auer was a modest chemist, who was on intimate terms with Rund—that Rund who initiated the victorious career of the Auer (Welsbach) light, and by lectures and articles, and by personal activity, has started the whole campaign so successfully in operation. Keeping the position of Rund before one's eyes, it is not strange that Auer then promised him that the firm of Rund and Co. should manage his affairs further. How understandable was his indignation, when he received the announcement from Dr. Gallia, that Auer had decided to conduct the business alone and without a partner, and offered Rund an appointment. Rund, who was incorporated in the official staff over which he had formerly been principal, was astounded at this announcement. In the year 1893, he brought an action against Baron Auer in the Commercial Court, and a compromise was effected, according to which Rund was sent to Switzerland as Auer's representative. Immediately afterwards, the Austrian Incandescent Gas-Light Company came into being, with a share capital of 3 million kronen (24 kronen = £1), of which Auer himself admits that the greater part of the shares were

already in sound hands, and with a jobber's profit ("agio") of 300 to 400 per cent. Rund abroad had lost all touch with the old sphere of his activity; but one thing kept revolving in his head, that Auer, 47 days after re-purchasing the old bad patents, had patented his new light. Had Rund had then the evidence which he has at the present time, he would not have betaken himself to Switzerland. In the year 1895, Rund, at the request of Dr. Gallia, signed a declaration stating that he had no title to any claims at all on Dr. v. Auer. In 1895, Rund still had no idea that things had not gone perfectly straight on the re-purchase of the patents; for if he had had a proof of it, Dr. Gallia would have taken a long time to persuade him, as he would then have known what to do.

Dr. Elbogen next described how, in the year 1900, at the Gause restaurant, Rund chanced to meet the confidential clerk (procurist) Friedmann, a former official of the firm of Lindheim. Friedmann related to him how, in the winter prior to the dissolution of the patent agreement with Rund, Herr Kuschenitz, Auer's former Secretary, had said to him in confidence that he ought to intimate to Herr Zwiklitz, of the firm of Lindheim, that Lindheim ought not to sell the Auer patents, as there were special things in progress. Kuschenitz, whom he had to promise to keep everything secret, took him also into Auer's laboratory, and showed him on a test lamp an incandescent light, which was more than 100 candles in intensity, and afforded a marvellously white light. Kuschenitz further said that the mantle was steeped with improved fluid. Lindheim had had a disagreement with the Auer Company, and he sold the patents. Friedmann, who soon afterwards left Lindheim, made no secret of what he had observed, and confirmed this announcement as well when he was a witness before the Court. The plaintiff tried to pass lightly over this significant fact, with the remark that Friedmann was not a technical man, and did not understand anything about the Auer light. It must not, however, be forgotten that the difference between the old and the new Auer light was many times greater than that between the Bremer light and the old arc lamp. Rund's most important point was Friedmann's statement, from which it appeared quite certain that Auer tested the new incandescent light in his laboratory months before the re-purchase of the patents. No judge in the world could get away from this fact; it constituted the proof that the invention of Dr. v. Auer was cut-and-dried on June 23, 1891, and was not indeed the invention of a new material, but only an improvement of the thoria-ceria mixture patented long before. Baron Auer himself, moreover, had confirmed it. In his patent case, he stated that he had manufactured and tested the new incandescent light before the patent publication, As he needed more than forty days to test the time it lasted when burning, it followed that the new incandescent light was already alight when the patents were taken out of the hands of the firm of Rund.

Dr. Elbogen then produced the draft of a letter which Dr. Gallia had composed and sent to Rund for signature. In this document Rund was to accuse himself of extortion. But Rund had rejected the draft with indignation. If the question were asked, why did Auer, with his knowledge of the new invention, give his assent to the sale of the patents by Lindheim to Rund, it must not be forgotten that Lindheim was a big firm, and Rund a poor man, who could easily be got the better of, and whose mouth could be stopped. If Auer had not adopted a ruse, Rund would not have given up the patents; he did not want the secret of the new mixing of the fluid, but the product.

The President had this composition put on the records, and expressed the opinion that the product of the present day could, by analytical chemistry, be resolved into its smallest atoms. Dr. Elbogen stated that Auer had shown the new light to his relatives and acquaintances, and had only not shown it to him to whom he was under obligation to do so. This at least constituted a civil wrong. As a final forcible argument, he added that Baron Auer wished to get rid of the depositions of witnesses by reason of section 153 of the St.-P.-O. (the State regulations of procedure in cases), so that he must be in fear of disgrace or considerable loss of property through questions being quite truthfully answered.

Dr. Elbogen appealed finally to the Court. The fetters of the old criminal procedure had been stripped off, the clear atmosphere of an unfettered valuation of evidence surrounded the Judges, who must recognize that the defendant had been misled and injured by cunning concealment of Auer's invention.

Dr. Gallia replied that what the previous speaker had said was wonderfully good, provided it agreed with the facts. He (Dr. Gallia) however, was in a position to gainsay all by documents. Baron Auer could swear that his invention was not completed on the 23rd of June, 1891; that he worked on it uninterruptedly until August; that he did not re-purchase the patents to enrich himself, but was forced to do so by Rund and Co. The plaintiff's representative must, however, cite a passage from the old penal code, in which it said: The parties must confine themselves to documentary facts, or, as we say briefly, to the truth. All was not true, however, of what had been brought forward here; and he could prove that it was not.

The President: Do you not think that, if the Court admits the argument, it would be superfluous now to bring much forward?

Dr. Gallia: Certainly; only I must ask, in case the argument is not admitted, to be allowed to speak.

After long deliberation, the President announced the following decision of the Court: The Court has admitted parts of the proofs of evidence, and

(1) Admitted the documentary evidence.

(2) By examination of the witnesses Felix Kuschenitz, Fred Williams, and Dr. Adolph Gallia, it must be ascertained when Baron Auer obtained the knowledge that he could get monazite sand from Brazil in the quantities needed for the production of thorium, and when Auer discovered the process for the extraction of thorium from monazite sand.

(3) The witness Theodor Friedmann must state when Kuschenitz showed him the new light for the first time.

(4) Manager Haidinger must state whether, and to what extent, the invention of the new incandescent light had already been completed on the 23rd of June, 1901.

(5) The plaintiff has to produce the record of the contents of the new incandescent light.

(6) Two sworn shorthand-writers will be admitted to the hearing of evidence

The evidence by the remaining witnesses concerned is rejected. The Court has reserved to itself the evidence to be got by examining the parties to the suit.

The President thereupon adjourned the proceedings.

A correspondent of the "Financial News," alluding to this case, writes: "It would be interesting for the shareholders in the Welsbach Incandescent Gas-Light Company, Limited, to know whether these proceedings, and also the action which it is stated that Rund is bringing against Dr. Auer for damages running into more than six figures, will be at the cost of the Vienna Company, in which the London Welsbach Company is practically the sole shareholder, or whether Baron Auer von Welsbach is paying the costs of these proceedings himself. The Vienna Court has called upon several witnesses to prove matters. Among these witnesses are Mr. Fred Williams, lately a Director of both the English and the Vienna Companies, Dr. Adolph Gallia, who holds the dual position of both President and Lawyer to the Vienna Company, Director Haidinger, the Chemist of the Vienna Company, and Mr. Felix Kuschenitz, who was the Private Secretary of Dr. Auer, and is now the Manager of the electrical department of the Vienna Company. The Judge also instructs that the books containing photometrical tests of Dr. Auer are to be produced; and this may throw some light upon the question of the validity of the 1893 patent held by the English Company in London. The result will doubtless be awaited with interest by the Welsbach shareholders."

Published References to the Discovery of 1891.

The case brings to mind much that was said and published at the time concerning Dr. Welsbach's invention of 1891, from which year dates improvement in the mantles of the Incandescent Gas-Light Company. In December of that year, Mr. Julius Moeller issued to the Gas Companies of this country a circular, which has since been much debated, but which we did not print at the time. In view of the above case, however, it is interesting to recall the terms of Mr. Moeller's "important communication," for so it was headed—

Important Communication.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

14, *Palmer Street, Westminster,*
London, S.W., December, 1891.

DEAR SIR,—We have much pleasure in bringing before your notice to-day our last invention as regards incandescent gas-light; and if you find that the figures as to lighting capacity are a little startling, I beg to point out to you that the experiments with these mantles have been made through a period of five or six months day and night, and I am prepared to supply you with the same quality of mantle, having exactly the same power of durability.

OUR NEW INVENTION CONSISTS IN A MANTLE GIVING 50 TO 60 CANDLE POWER FOR A PERIOD OF 3000 HOURS AND MORE.

The drawback to the Welsbach light, as introduced in its original form, was not so much the fragility of the mantle, as a continual decrease in light during the 600 to 800 hours that it lasted, due to the chemicals employed forming certain combinations injurious to the lighting properties of the mantle.

The new invention which we are introducing now is most startling in every respect. Formerly, we had to use in the manufacture of our mantle, six or seven minerals the manufacture of which was very difficult indeed. At the present moment, we have to do with only two, and these can be manufactured with an absolute guarantee of their pureness of quality; and there is no difficulty whatever in keeping up a steady supply of these mantles.

At the foot of this letter, we give you the photometrical tests of half-a-dozen mantles prepared with this fluid, and you will find that all these mantles have a much higher lighting power than 60 candles—in fact, most of them have over 70; and the reason for this is, that we used a choked chimney. But we find that, for practical purposes, this light is much too intense; and we therefore fall back upon the ordinary argand chimney, which still gives 60 candle power, and which prolongs the life of the mantle considerably.

The lamp we offer you now at the same price as the former lamp, consumes 3 feet of gas per hour, and produces a light of 50 to 60 candle power; and we claim that there is no other artificial light in the market that can rival our new burner.

There is no doubt that the future of the incandescent gas-light will be an enormous one, and in addressing ourselves to you and to gas companies in general, we do this because we think that the gas companies ought to be the retailers of the Welsbach light—the only one in the market that can compete with electricity; and if gas companies take it up, and push it with energy, electricity, on account of its expensive installation, could make very little headway indeed.

Our experience is that gas companies have up to now rather condemned the Welsbach light, because they think that the small amount of gas we use for our burners is to their disadvantage; but we must point out to you that, in our experience, it invariably happens that, where a house or restaurant is lit up originally with (say) twelve burners, the introduction of a really good light increases the demand for light, and, after a very short period, more lamps and more burners are required.

For the same reason, if you take up the sale of our incandescent lights, it is quite certain that, in all those places where you supply gas at the present moment, and where gas is burnt through fishtail or argand burners, or by means of regenerative lamps, the consumption of gas will be reduced greatly; but the very fact of obtaining such a brilliant light with our burner will induce a great many people who at the present moment do not burn gas to adopt our lights, and in this way you will obtain a great many new customers, and in all such places where electric light is obtainable a most effective check against the further progress of electricity is gained by the adoption of our light.

These are my reasons for offering you the agency of our lamps. Should you be inclined to take up the sale of our burners in your town, I am prepared to supply you with all material, such as pamphlets, printed matter, &c.; and I expect that you will push this light with energy and seriously, and, on the other side, I shall put at your disposal such material as described before.

Of course, the remarks we made about the old lamps hold good to the new ones too—*i.e.*, the combustion of our lamps is perfect; there is no smoke, and the heat is very much less with our lamps than with other burners.

The cost of the mantle and the chimney can hardly be felt as an expense, as the mantle lasts such a long time, considerably over one year, and the expense of the mantle and chimney will be richly saved by the smaller quantity of gas used.

We beg you to let us know whether you intend taking up this matter; and we shall be pleased to supply you with a sample burner at list prices, less 30 per cent., but we should expect orders for not less than six to twelve lamps at a time.

We beg you to give this matter your full consideration, and to let us know your decision at your earliest convenience, so that we may make our arrangements still for the present season.—Yours truly,

J. MOELLER.

N.B.—We are prepared to allow the same discounts as heretofore—*i.e.*, 30 per cent., and 2½ per cent. cash monthly.

Photometrical Tests of the New Incandescent Mantle.

	Mantle Put Up and Lighted.		Original Candle Power.	
I.	15/4/91.	..	87	Giving 65-candle power after burning 2800 hours day and night.
II.	30/5/91.	..	90	Giving 65-candle power after burning 3000 hours, day and night.
III.	29/7/91.	..	82	Giving 75-candle power after burning 2000 hours, day and night.
IV.	2/9/91.	..	94	Giving 94-candle power after burning 800 hours, day and night.

About twelve months after the issue of this circular, we reported in the "JOURNAL" (Dec. 6, 1892), the proceedings at the fifth annual meeting of the Incandescent Gas-Light Company, Limited; and some remarks were then made bearing upon Dr. Welsbach's discovery of 1891. In the course of his address to the shareholders, the Chairman (Admiral Sir Edward Inglefield) said:

In August of last year, the Directors informed the shareholders that Dr. Auer von Welsbach had practically completed a process, by means of which he could make a lighting fluid with which to impregnate the mantles, with the result that the mantle, instead of giving a light of 25 to 30 candles, would give from 60 to 80 candles, according to the form of burner and chimney used. In addition to this, the mantles would have a considerably greater lasting power than those hitherto used. . . . The lamps supplied gave such good results, and so commended themselves to the public, that this season they were reaping the benefit—the sales for the last three months having been from four to five times as great as in the corresponding period of last year.

BUILDING CONTRACTS AT GRANTON GAS-WORKS.

The Stonework Contract.

In the Court of Session, on Thursday, the 20th ult., Lord Stormonth-Darling was to have heard evidence in the action in which Alex. Forbes, jun., mason and builder in Edinburgh, sued the Edinburgh and Leith Gas Commissioners for £523 as a balance due upon his account for the setting of the stonework of the retort-house, coal-store, and other buildings at the new gas-works at Granton. The pursuer founded upon the custom of the trade with regard to the measuring of such work. The defenders' maintained that the employment of the pursuer was regulated by special conditions which excluded the custom of the trade. They admitted £120 being due; and that sum they paid after the action was raised. The pursuer claimed a further £70 in respect that he was entitled to the full cubic measurement of the stonework set by him. The defenders maintained that they were only liable to pay the net cubic measurement; and on that footing the £120 was all that was due. The defenders, however, paid the £70 to the pursuer on the 13th ult. The balance of the pursuer's unadmitted claims amounted to above £300 for cutting and jointing stones, washing down the whole stonework a second time, and compensation in respect of defenders themselves setting part of the buildings in stone which the pursuer held fell under his contract. The defenders denied liability for these sums. On the case being called on the 20th ult., Mr. Shaw, K.C., for the defenders, stated that there would be "a labyrinth of skilled evidence" on both sides; and Mr. Watt, K.C., for the pursuer, had met him by accepting, in addition to the sums already paid, an offer of £105, with full costs. Decree for this sum and expenses was accordingly given in favour of the pursuer.

The Brickwork Contract.

The following Saturday, Lord Kyllachy gave his judgment in the action by Messrs. George Wigmore and Co. against the Edinburgh and Leith Gas Commissioners, which was recently at proof before his Lordship. The pursuers were the Contractors for the erection of the brickwork portions of the buildings; and they sued for three sums of £574, £320, and £321, as balances said to be due to them. The whole work under the contract was completed before Nov. 1, 1901; and the pursuers received payment of £2277. The pursuers contended that the value of the work done by them at contract rates was £3201; and the sum first sued for was the difference between this amount and £2277. The sum second concluded for was the balance of the contract price; and the amount in the third conclusion was said to be due in respect of extra work, &c. Liability was denied by the defenders, who said that the work contracted for had not been completed to the satisfaction of their Engineer. They explained that on Dec. 26, 1901, they offered to relieve the pursuers of all further liability in respect of the contract, and to pay them £600 in full of their claims. The offer was rejected by the pursuers, as was also a proposal to refer all questions in dispute to arbitration

In the course of his judgment his Lordship said the case had involved a long and expensive proof. The first question between the parties was as to the substitution, during the contract, of brick pilasters for the stone pilasters which, according to the pursuers, were originally contemplated, and which, if built of stone, did not fall under the pursuers' contract at all. Upon that matter, he was bound to say that he did not see his way to adopt the defenders' reading of the contract. But, on the other hand, he was also bound to say, having given the Contractors' case every consideration, that the amount which they claimed was very much exaggerated. They claimed 2s. per rising foot for the extra labour upon the pilasters. He thought he was considerably stretching the point in allowing them more than 2d. per rising foot, which figure, he thought, most of the defenders' witnesses suggested. But, having in view some part of the evidence in connection with the cutting of bricks, and other minor details, he thought he should not do injustice in allowing them 4d. per rising foot. The result of this was that, whereas the pursuers had claimed £388 7s. 10d. in respect of the pilasters, he allowed only one sixth of that, which came to £64 13s. 4d. The next matter, which was a minor one, associated with the pilaster question, was a claim of £27 17s. 7d. for facing brick into the main walls. He was unable to hold that claim to be established, and he therefore disallowed it. The next claim which the pursuers made was an allowance of £150 for scaffolding. This sum was claimed in respect of the pursuers having, under arrangement with the Engineer, substituted different scaffolding arrangements to those under the contract. What they said was that the new arrangements involved the use of trestle scaffolding. He could not, in the first place, leave out of account that the alleged new arrangement about the scaffolding was one which was really of the nature of the compromise of a difficulty, and that the pursuers, when they adopted the new arrangement—either suggested by themselves or by the Engineer—had it in their power, if they thought that the new method was more expensive than the old, of stipulating for additional payment. This, however, they did not do; and no payment of the kind was suggested until the action was raised. In the circumstances, he did not see his way to make any allowance for the alleged extra cost of scaffolding. With regard to the claim in respect of breeze, which was, to some extent, substituted for sand in preparing mortar, he said it was in the same position, in this respect, that no suggestion of the claim was made during the progress of the contract. Therefore, he thought it would require to be made quite clear that the pursuers did really, in consequence of that substitution, incur extra cost in the way of extra labour. It was, he thought, impossible to say that this was made clear. He did not find any evidence that the Contractors incurred any additional cost, in the way of wages, by reason of the substitution of breeze for sand. So he disallowed the £120 claimed for the substitution of breeze. The result was that the pursuers, after allowing for £137 paid since the action was raised, claimed £1078. Allowing the £64 odd, and disallowing the claims of the pursuers otherwise, there would remain a sum of £456 7s. 11d. still payable to the Contractors, upon the footing that they were to complete the work. But the defenders proposed to complete the work themselves—and he thought that was a matter of course—and to retain £56 as the cost of the work. This left a sum of £400, for which decree would be given. As to expenses, although the pursuers had achieved a certain success in the matter of the pilasters, they had not achieved anything like the success which they intended. As to this, he thought there should be no expenses. But in the matter of what he might call the winding-up of the contract, he must consider the defenders' refusal to pay the sum which was now admitted to be due. While he considered defenders were somewhat stiff, he thought that the Contractors, who had evidently lost their temper, were more unreasonable; and, as regarded all that, he should not allow expenses to either party. The result was that the defenders must have their expenses, but subject to a modification of one-fourth, in round numbers, as he had indicated.

The "Vivid" Mantle Action.

In the Chancery Division of the High Court of Justice last Wednesday, before Mr. Justice Byrne, the proceedings in the above matter, which were opened on the 28th ult. (*ante*, p. 1479), were mentioned. It may be remembered that a motion was made on behalf of Messrs. Beven and Alexander, the makers of the "Vivid" incandescent mantle, for the sequestration of the property of the Welsbach Incandescent Gaslight Company and the committal of the Directors, for their alleged contempt of Court in disobeying a consent order made by Mr. Justice Buckley in June last. Mr. Rowden, K.C., for the plaintiffs, now stated that communications had passed between the parties, as the result of which it was hoped that all questions between them might be settled. If the motion stood over until Friday week (the 12th inst.), he hoped his Lordship would not be troubled with it. Mr. Levett, K.C., for the Welsbach Company, acceded to this suggestion.

Portsmouth Water Company.—The half-yearly general meeting of this Company was held on Thursday week—Mr. W. Grant, J.P., in the chair. In moving the adoption of the report, noticed in the "JOURNAL" for the 18th ult., the Chairman explained that the reduction in the quantity of water consumed in the six months covered—which had amounted, for all purposes, to 8,138,000 gallons daily—was attributable to the fact that last summer was a wet one, and to the adoption by the Directors of measures for preventing waste. No defect had shown itself in the 36-inch rising main which had been laid from Bedhampton to the Portsdown Hill reservoir; and a 20-inch main was being laid to the Dockyard for the special use of the Admiralty, which would yield a handsome return for the outlay. Reference was made to the retirement of the Company's Resident Engineer (Mr. H. R. Smith), and the appointment of Mr. Herbert Ashley, Assoc.M.Inst.C.E., as his successor. The report was adopted.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The London County Council and the Gaslight and Coke Company.

At the Meeting of the London County Council last Tuesday, the Chairman of the Parliamentary Committee (Mr. G. H. Radford) presented the report on their proposal to introduce a Bill next session to amend the Acts of the above-named Company, given in the "JOURNAL" for the 2nd inst., and moved that the recommendation at the end thereof—to the effect that the necessary steps should be taken to promote the Bill—should be adopted. In doing so, he pointed out that the report contained a clerical error in the final words of the second paragraph, where it was stated that "the reduction of illuminating power to 14-candle gas should result in a lowering of the Company's charge for public lighting from 2s. 3d. to 2s. 1d." These figures should, he said, be 2s. 5d. and 2s. 3d. Mr. Beachcroft characterized the Bill as a most unprecedented one. He said he did not propose to raise any question as to the policy involved, because the Council had already decided to promote a Bill; but at the close of the report there was an observation in regard to which he thought it right to ask the Chairman of the Committee a question. The report stated that the Committee had given directions for a copy of the Bill to be sent to the President of the Board of Trade for his consideration. This, no doubt was done, pursuant to the words added to the resolution at his (Mr. Beachcroft's) instance in June. He wished to know if the Chairman of the Committee had ascertained whether the President was likely to offer assistance to the Council in the promotion of the Bill, and whether, if he found there was no hope of this, he would still recommend the Council to proceed. He was speaking merely in the interests of economy. The Bill had not much chance unless it received the support of the Government, for it struck at the root of all private bodies; and he had the greatest doubts as to whether the Council had any chance of succeeding with it unless they had the Government behind them. He wished to ask whether any communication had been made directly to the President of the Board of Trade, in addition to formally sending him a copy of the Bill; and, if not, whether steps would be taken to ascertain what view the President was likely to take upon it. Mr. Radford, in reply, said the Committee were in communication with the President of the Board of Trade with reference to the Bill. They were not without hope of obtaining some assistance from him, or, at any rate, ensuring from him an attitude of friendly neutrality. If this should be so, the Committee thought that perhaps with a strong case, based on the facts of the recommendations of Sir James Rankin's Committee, there was a fair prospect that they might be able to persuade the Legislature to carry the Bill through. He should like to add that, since the report was brought up to the Council and the Committee had met, they had received a communication from the City of London, to the effect that the Court of Common Council substantially approved of the measure; and the Committee hoped to have the benefit of the co-operation of the City at further stages. The recommendation was agreed to.

BIRMINGHAM GAS AND WATER SUPPLY.

A New Retort-House for Nechells—Progress of the Welsh Water Scheme.

At the Monthly Meeting of the Birmingham City Council on Tuesday last, reports by both the Gas and Water Committees came up for consideration.

Mr. BISHOP, the newly-appointed Chairman, submitted the report of the Gas Committee (the principal portions of which were given in the "JOURNAL" for the 25th ult., p. 1419), and moved that the authority to borrow £202,000 for works at Windsor Street and Adderley Street, under the scheme of 1898, be rescinded, and that in lieu thereof the Committee should be authorized to apply to the Local Government Board for power to borrow £165,000 for the erection of works at Nechells, and £35,000 to meet the further cost of installing prepayment meter supplies. He explained that it was necessary for the Gas Committee to look at least eight years ahead as to the requirements of their plant, and to make arrangements for extensions and reconstructions at least five years before they commenced them. Since they brought up certain recommendations in 1898, two things had occurred which suggested their revision. One was the acquisition of the land at Birches Green, of which they had no hope in 1898; and the other was the resignation of Mr. Hunt, and the placing of the whole undertaking under one Engineer. The alterations originally contemplated at Windsor Street would have caused the space there to be greatly crowded; while the Adderley Street site was unsuitable for large modern plant. Not only was it at different levels and inconveniently divided by roads and canals for modern requirements, but the coal carbonized there cost 1s. per ton more than at other works. The Committee had recently asked Mr. Hack to report upon the whole subject; and he recommended that, instead of what was originally proposed to be done at Windsor Street and Adderley Street, it would be more economical to erect further plant at Nechells, with a producing capacity of 5 million cubic feet a day. There would be a saving in this of £37,000; and it would yield 1½ million cubic feet more per day than the former scheme. Such a retort-house had been in contemplation; and in connection with a similar house already erected, preliminary work, such as foundations, had been carried out worth £21,000.

The resolution having been seconded,

Mr. WALTHALL moved the following resolution, of which he had given

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1532.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin 10 p.c.	18—19	..	5 10 6
100,000	10	,,	7½	Do. 7 p.c.	12½—13½	..	5 11 1
300,000	100	July 1	5	Australian 5 p.c. Deb. .	100—102	..	4 18 0
200,000	5	Nov. 13	6⅓	Bombay, Ltd. . . .	5⅜—6	..	5 8 4
40,000	5	,,	6⅓	Do. New, £4 paid	4—4½	..	5 15 6
380,000	Stk.	Aug. 14	12	Brentford Consolidated	247—252	..	4 15 3
270,000	,,	,,	9	Do. New . . .	180—185	..	4 17 3
50,000	,,	,,	5	Do. 5 p.c. Pref. .	134—139	+9	3 11 11
206,250	,,	June 17	4	Do. 4 p.c. Deb. .	111—114	..	3 10 2
220,000	Stk.	Sept. 11	10⅔	Brighton & Hove Orig.	207—212	..	5 1 5
246,320	,,	,,	7⅛	Do. A. Ord. Stk. .	152—157	.	4 18 9
460,000	20	Sept. 26	10	British.	39½—40½	..	4 18 9
50,000	10	Aug. 14	12	Bromley, Ord. 10 p.c. .	22—24	..	5 0 0
82,850	10	,,	9	Do. 7 p.c. . . .	18—20	..	4 10 0
500,000	10	Oct 15	7	Buenos Ayres (New) Ltd.	10—10½	..	6 13 4
250,000	Stk.	June 24	4	Do. 4 p.c. Deb.	94—96	+1	4 3 4
150,000	20	July 11	8½	Cagliari, Ltd. . . .	23—25	+2	6 12 0
100,000	10	Sept. 26	10	Cape Town & Dis., Ltd.	14⅜—15½	..	6 9 0
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	53—55	..	5 9 1
550,000	Stk.	Oct. 15	12½	Commercial Old Stock	260—265	..	4 14 4
251,875	,,	,,	5⅛	Do. New do. .	203—205	..	4 12 8
271,875	,,	June 12	4⅜	Do. 4½ p.c. Deb.	130—134	..	3 7 2
800,000	Stk.	May 28	8†	Continental Union, Ltd.	138—143	.	5 11 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	142—146	..	4 15 11
575,000	Stk.	Aug. 28	5⅝	Crystal Palace Ord. 5 p.c.	117—122	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref. .	120—125	..	4 0 0
106,158	,,	July 11	5	Do. 5 p.c. Deb. Stk.	139—142	..	3 10 5
486,090	10	July 30	10½	European, Ltd. . . .	17⅛—18½	..	5 13 6
354,060	10	,,	10⅓	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Aug. 14	4	Gas-light and Coke	4 p.c. Ord. . .	84—86	.. 4 13 0
					3½ p.c. max. .	87—89	.. 3 18 8
					4 p.c. Con. Pref.	110—112	+1 3 11 5
					3 p.c. Con. Deb.	91—93	.. 3 4 6
2,600,000	,,	,,	3½	Hongkong & China, Ltd.	14⅜—15⅝	..	5 3 3
3,799,735	,,	,,	4	Imperial Continental .	201—204	..	4 18 0
4,193,975	,,	June 12	3	Do. 3½ p.c. Deb. Red.	99—101	..	3 9 4
70,000	10	Oct 30	8	Liverpool United A	223—225	..	4 8 11
3,800,000	Stk.	Nov. 13	10	Do. do. B .	165—167	..	4 3 10
473,600	Stk.	Aug. 14	3½	Do. do. Deb. Stk.	116—118	..	3 7 10
561,000	Stk.	Aug. 28	10	Malta & Medn., Ltd. .	4—4¼	..	5 11 1
718,100	,,	,,	7	Met. of 5 p.c. Deb.	104—108	..	4 12 7
306,083	,,	June 24	4	Melbourne 4½ p.c. Deb.	102—104	..	4 6 7
75,000	5	June 12	5	Monte Video, Ltd. . .	9—10	..	7 0 0
560,000	100	Oct. 1	5	Newc'tle & G'tesh'd Con.	104—105	..	4 5 9
250,000	100	,,	4½	Do. 3½ p.c. Deb.	99—100	..	3 10 0
541,920	20	Nov. 13	5⅜	Oriental, Ltd. . . .	140—145*	..	5 10 4
1,515,892	Stk.	Aug. 8	4½	Ottoman, Ltd. . . .	6⅞—7	..	5 0 0
346,855	Stk.	July 4	3½		* Ex div.		
300,000	Stk.	Nov. 27	8				
60,000	5	Sept. 26	7				

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
851,070	10	Oct. 15	7	River Plate Ord. . .	10—10⅜	..	6 13 4
300,000	Stk.	June 24	4	Do. 4 p.c. Deb..	94—96	+2	4 3 4
250,000	10	Sept. 26	8	San Paulo, Ltd.. . .	11⅛—12⅛	..	6 8 0
135,000	Stk.	Sept. 11	10	Sheffield A	236—238	..	4 4 0
209,984	,,	,,	10	Do. B	235—237	..	4 4 5
523,498	,,	,,	10	Do. C	234—236	+1	4 4 9
6,000,000	Stk.	Aug. 14	5⅜	South Met., 4 p.c. Ord.	117—120	..	4 8 10
1,700,000	,,	July 11	3	Do. 3 p.c. Deb. . .	91—93	..	3 4 6
380,940	Stk.	Nov. 13	5	Southampton Ord. . .	103—107	..	4 13 6
87,950	,,	July 11	4	Do. 4 p.c. Deb.	102—105	..	3 16 2
120,000	Stk.	Aug. 28	6	Tottenham and Edmonton A. 5 p.c.	118—123	..	4 17 7
300,520	,,	,,	4½	Tottenham and Edmonton B. 3½ p.c.	93—96	..	4 13 9
182,380	10	Jan. 16	5	Tuscan, Ltd.. . . .	7—8	..	6 5 0
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96—98	..	5 2 0
230,000	5	Aug. 14	9½	West Ham, 10 p.c. . .	10—11	..	4 6 4
172,000	10	,,	6½	Do. 7 p.c. . .	13½—14½	..	4 9 8
				WATER COMPANIES.			
780,599	Stk.	June 24	11⅓	Chelsea, Ord. . .	310—320	..	3 11 11
150,000	,,	,,	5	Do. 5 p.c. Pref. .	152—157	..	3 3 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—143	..	3 2 11
175,785	,,	Sept. 26	4½	Do. 4½ p.c. Deb. .	137—142	..	3 3 5
1,720,560	Stk.	Oct. 15	8	East London, Ord.. .	217—222	+1½	3 12 1
654,740	,,	June 12	4½	Do. 4½ p.c. Deb. .	142—147	..	3 1 3
1,282,943	,,	,,	3	Do. 3 p.c. Deb. .	97—99	..	3 0 7
700,000	50		8	Grand Junction 10 p.c. max..	110—115	..	3 9 7
310,000	Stk.	Sept. 26	4	4 p.c. Deb..	125—130	..	3 1 7
708,000	Stk.	Aug. 14	14	Kent	290—300	..	4 13 4
160,000	,,	,,	7	Do. New, 7 p.c. max..	195—205	..	3 8 4
1,043,800	100	June 24	11	Lambeth, 10 p.c. max..	298—303	..	3 12 7
406,200	100	,,	8½	Do. 7½ p.c. max..	215—225	..	3 15 7
350,000	Stk.	Sept. 26	4	Do. 4 p.c. Deb..	125—130	..	3 1 7
500,000	100	Aug. 14	12⅛	New River, New Shares	385—395	..	3 4 9
1,000,000	Stk.	July 30	4	Do. 4 p.c. Deb..	125—130	..	3 1 7
902,300	Stk.	June 12	7	Southwark Ord. . . .	195—200	..	3 10 0
126 500	100	,,	7	7½ p.c. max.	180—185	..	3 15 8
489,200	Stk.	,,	5	and 5 p.c. Pref.	153—156	..	3 4 1
1,019,585	,,	Oct. 15	4	Vauxhall 4 p.c. A Deb.	123—128	..	3 2 6
1,155,066	Stk.	June 12	10	West Middlesex. . .	280—290	..	3 9 0
200,000	,,	,,	4½	Do. 4½ p.c. Deb. .	139—144	..	3 2 6
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb. .	95—97	..	3 1 10
					* Ex div.		

† Next dividend will be at this rate.

notice: "That the information given by the Gas Committee in their report applying for power to borrow the sum of £200,000 is insufficient, and not in accordance with the suggestion made by the Finance Committee, and approved by the Council, that details on any proposed expenditure on industrial undertakings should be given; and this Council is of opinion that, before further borrowing powers are applied for, the question of the development of electric supply rather than extension of the gas undertaking should be considered." He said it was not the first time he had protested against the Gas Committee seeking leave to borrow money on capital account without giving detailed particulars of their expenditure. Such particulars had to be furnished very fully to the Local Government Board Inspectors; and he thought they should be given in the first place to the Council, as was done by other Committees. There was a delightful vagueness about the expression concerning the proposed works at Nechells, "at an estimated cost of, say, £165,000." The Committee had changed their minds as regarded the loan to be applied for, and now as to the works they proposed to erect. Why had they changed their minds? The objections urged against the originally proposed extensions at Adderley Street and Windsor Street applied equally in 1898; but why were they not mentioned? He urged that the Committee should take the report back and reconsider the whole of their scheme, together with the relationship between the Gas Department and the electric supply. No one could say that the electric supply was perfect; and up till now it had had no opportunity of developing itself. The gas undertaking, having been in full swing for about thirty years, had a great advantage over a business that had been in their hands only for a short time; and he feared that the more they spent on the gas, the greater would be their objection to spending on electricity Was there any necessity to perpetuate this position? If they had now to start afresh, and had to choose between gas and electric light, he thought they would select electricity. (Cries of "No.") Were they then by their votes from time to time to increase the difficulty? It went without saying that, so long as they had only one article to sell, the public must of necessity buy it. If they were in a position to take electricity to the door of the consumer, and to offer it at such a price that it would be cheap, consumers would take it instead of gas. He suggested that now was the proper time to consider this subject, inasmuch as a number of the suburban authorities were promoting electric supply schemes, and would shortly be large users of electricity. The districts to which he referred at present took nearly 20 per cent. of the output of gas; so that when their schemes were complete, about a fifth of the consumers would leave them, and these extensions of plant would be unnecessary. He drew a picture of the astonishment of a future visitor to Birmingham, who, entering the city through electrically lighted suburbs, came upon the city streets still lighted by gas. He also mentioned the probability of Mond gas diminishing the demand for coal gas for manufacturing purposes. He thought that, either by a Joint Committee or in some other way, they should have a complete inquiry into the relations of the gas and electric supplies, so as to prevent their overlapping.

Mr. STEVENS supported the recommendations of the Committee, on the score that they tended to economy and good management. There was no reason why there should not be some understanding between the Gas and the Electricity Departments; but this was a subject altogether apart from the merits of the recommendations which the Gas Committee were now submitting. Mr. Walthall had complained of the Committee altering their minds. They had done so; but, circumstances having changed, they were wise to reconsider their plans. The existing gas plant afforded only a small margin of capacity beyond the demand; and this would soon be absorbed. They did not find any diminution from the use of electricity. Indeed, gas had taken renewed hold both for lighting and heating, and in many cases incandescent gas lighting had superseded electricity.

Alderman Sir JAMES SMITH said they should never blame a Committee for bringing up an altered scheme, if one which had been adopted could be improved. He very much doubted whether the outside districts would use electricity for street lighting. It was not so great a success for this purpose as was incandescent gas. He did not think that the outside authorities taking power to supply electricity would at all affect the increase in the consumption of gas, because miles of new streets were being built in these districts, in which the inhabitants would always use gas.

Mr. HUNT thought the Committee had made out a good case; but, at the same time, he had a sneaking sympathy for the part of the amendment which related to the electric light. He did not think the town was at all satisfied with the management of the electric light undertaking. The price charged was much higher, and the development much slower, than in other places.

Alderman J. H. LLOYD, in supporting the resolution, pointed out that the Corporation were under statutory obligation to meet the demand for gas; and they must guard themselves from any failure such as he remembered them nearly incurring one Christmas Eve, just after he entered the Council. It was not right that such a great city should run a risk like this. The electric light had not superseded gas; but the rivalry had led to the development of the latter. As regarded Mond gas, while it might have advantages for consumption near to the place of its production, it was very doubtful if it would pay to convey it considerable distances.

Alderman BEALE, in supporting the Committee, reminded the Council that when the electric light was first introduced into the central ward of the town, they expected to see a marked diminution in the gas consumption of that area; but quite the reverse proved to be the case, and their receipts actually went up as a result of the impetus given to better lighting. With regard to the demand for complete details, it was quite a different thing to go to the expense of preparing these to submit to the Local Government Board, and incurring that expense before they knew whether the Council would approve the general scheme.

On the vote being taken, the amendment received only two votes, and the original resolution was carried.

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The report of the Water Committee was then presented. In the course thereof, they stated that during the past summer no difficulty had been experienced in meeting the demand for water. This favourable result was entirely due to the very unsettled weather which prevailed throughout the season. The average daily consumption for the six months from Lady-day to Michaelmas amounted to 18,370,890 gallons, against 19,205,027 gallons during the corresponding period in the previous year. In one week only (ending July 10) was any special strain experienced, and in that period the consumption reached a total of 158,122,337 gallons; giving an average of 22,588,905 gallons per day. The highest day consumption in the week was on the Thursday, when it reached a total of 24,355,000 gallons. The total for the week, and also the quantity of water distributed on the highest day, exceeded any results previously recorded in the Water Department. Last year the maximum week gave an average of 22,391,548 gallons per day; the highest day being July 20, when the quantity distributed was 24,297,000 gallons. Referring to the Welsh scheme, the Committee explained that the delay which had occurred in the completion of the works had led them to consider the prospective demand for the summer of 1903, which it might be assumed would exceed anything hitherto experienced. They had been unable to obtain any further temporary supplies; and, after much consideration, had resolved to utilize the Frankley reservoir, which was now practically complete, for the purpose of storing in the coming winter and spring any surplus water during times of moderate demand. With regard to the works in the Elan Valley, the Committee furnished details of the various sections, which showed that the progress had been satisfactory. In connection with the scheme for the administration of the Elan supply system, the Committee, upon the advice of Messrs. James Mansergh and Sons, advised the appointment of Mr. F. W. Macaulay, M.Inst.C.E., as Resident Engineer, at a salary of £600 per annum, rising to £700 when the Welsh water is delivered in Birmingham, and to £800 three years afterwards. The Committee explained that an appointment to this position was required to be made without delay, in view of the completion of the works on several of the contracts, which would involve the termination of the engagement of the Constructing Engineers. Mr. Macaulay had been the Resident Engineer for the construction of the Frankley reservoir and works since the letting of the contract in June, 1897; and he had also been throughout Resident Engineer on the section of the aqueduct from Hagley to Frankley. By his experience at the latter place and on the aqueduct, he had had special opportunities of acquainting himself with the most intricate parts of the works; and the Committee accepted with confidence the recommendation of the Engineers that in Mr. Macaulay they had secured a gentleman well fitted to undertake the duties assigned to him.

Alderman LAWLEY PARKER moved the appointment of Mr. Macaulay as recommended by the Committee, as Resident Engineer of the Elan works.

Alderman CLAYTON seconded the motion; and it was carried.

Alderman LAWLEY PARKER then moved the adoption of the report. In doing so, he congratulated the Council, as the Water Committee had congratulated themselves, on a fact which had not been very pleasant for most people, but which had been a great help to the Water Department—viz., the unsettled weather of the past summer. It had really tided the Committee over the year in a very remarkable way. The average demand for water was below that of the previous twelve months, notwithstanding that they had to provide each year half-a-million gallons more per day for the increased population. As evidence of what their position would have been if the summer had been a dry one, he mentioned that in one week of hot weather in July the demand exceeded that of any previous period. The Elan Valley works, except the filtration works, were approaching completion; and so were the aqueduct and the Frankley works. But for the filtration at the Welsh end, the water could have been delivered in Birmingham next summer. The work in connection with the filter-beds was very heavy, and the Engineers had said that, by working day and night with the full staff, it would take them all their time to bring the water to Birmingham by the summer of 1904. He hoped nothing unforeseen would occur to prevent this being done; but even then the whole of the works in connection with the compensation supply would not be completed until the spring of the following year. Still, this would not prevent Birmingham having a supply of the Welsh water. The additional year's delay occasioned the Committee great anxiety in respect to the increased supply of water which would be required. There were no further temporary supplies to be obtained, and so they had decided to use the Frankley reservoir for storing the surplus water. The mains were now being tested; and when they were finished, the water could be pumped into the reservior, and they might be able to turn into it, as circumstances permitted, the half-million gallons a day they received from the East Worcestershire Company until the reservoir was filled. By maintaining the additional storage, the Committeee hoped to satisfactorily pass through the extra year. They also proposed to afforest the Elan Valley, commencing with 75 acres, for one reason because it would promote the rainfall.

Alderman Sir J. SMITH seconded the motion; and it was carried.

Sale of Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards sold, by order of Directors and others, various parcels of stocks and shares. A new issue of £7000 of consolidated ordinary stock of the Lea Bridge District Gas Company, ranking for a standard dividend of 5 per cent., subject to the sliding-scale (last dividend 6⅛ per cent.), was sold at £120 per £100 of stock; some 4 per cent. perpetual debenture stock fetching £101 10s. to £103 per cent. A new issue of £10 "F" ordinary shares, carrying 7 per cent. dividend, in the Aldershot Gas and Water Company, were sold at prices ranging from £13 2s. 6d. to £14 each. Some "B" consolidated stock of the Wandsworth and Putney Gas Company (standard dividend 3½ per cent., but last at the rate of 6 per cent.) fetched £123, £123 10s., and £124 per £100 of stock.

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THE FATAL GAS EXPLOSION AT MAIDSTONE.

The inquest has now been completed on the body of Ernest Seager, who was killed by a gas explosion which took place on the bridge crossing the Medway at Maidstone, as reported in the JOURNAL for the 25th ult. (p. 1420). The Coroner (Mr. R. T. Tatham) sat twice, but on the first occasion only took sufficient evidence to enable him to give a certificate of burial. At the commencement of the proceedings, Mr. R. Hoar, the Secretary of the Gas Company, asked to be allowed to say how deeply the Company regretted the sad accident, which seemed to have been in some way connected with an explosion of gas. The Directors desired him to say that they hoped there would be the fullest inquiry into the cause of the disaster, and that officials would give every possible facility that those inquiries should be complete. The Coroner said the Jury only had to trouble about what was the cause of death, for it did not matter to them who was liable. Mr. A. J. Ellis (who appeared for the relatives of the deceased) remarked that in the case of a stabbing affray it was the duty of the Jury to find out who inflicted the wound. This seemed to be a parallel case; and he therefore hoped the Coroner would go further than he had first suggested. The Coroner said he would consider the matter. Walter Seager, who identified the body as that of his brother, said the deceased was a great smoker. He had been told that he was smoking a cigarette on the bridge just before the explosion. Thomas Cooker, an unemployed reservist, said that on the night of the accident he was on the east end of the bridge, and heard an explosion. There was no flame at all with it; but he saw a quantity of stones and dust flying in the air. When he got on to the bridge, there was a strong smell of gas. Dr. N. E. Gibbs gave evidence to the effect that deceased died from compression on the brain. The inquest was adjourned to allow of an inspection by the Board of Trade; but the Board declined to take any steps in the matter.

When the proceedings were resumed last Wednesday, a man named Simmonds deposed to lighting three matches, and throwing them down where the explosion occurred. He had only walked about twenty yards, when the flag-stones were hurled into the air. Mr. H. Smythe, the Manager of the Company, admitted having received several complaints since last January from the Borough Electrical Engineer of an escape by the electric arc lamp 120 feet away from the bridge. Several attempts had been made to discover the escape by opening up the road, and cement was placed around the foot of the arc standard; but there was at the present time a smell of gas there—the lamp-cleaner still complained of it. He had known since June, 1901, of the cavity under the bridge. It was not his business to see to that. The Jury returned the following verdict: "That the deceased man Seager met his death by an explosion of gas on the bridge; but, in the absence of scientific evidence, the Jury are unable to say how the explosion occurred. In their opinion, however, the immediate cause of the explosion was an ignition of a body of gas under the pavement; and they recommend that the cavity be filled in."

GAS AND ELECTRICITY IN MANCHESTER.

Street Lighting—Dr. Bishop's Resignation.

In moving the adoption of the minutes of the Gas Committee at the meeting of the Manchester City Council last Wednesday, Alderman Gibson read a letter from Councillor Grimes asking why the gas lighting in the street-lamps was so bad, and why the mantles of the lamps along Union Street, Ancoats, were half of them broken and not attended to in the same manner as they were in the streets in the centre of the city. In answer to the last question, Alderman Gibson said Union Street was an important thoroughfare, but it was also an exceedingly narrow one. Lamps could only be fixed on one side of the street. Brackets were put on the walls of the buildings; but owing to the vibration of the mills, the mantles were so rapidly destroyed that the lamps were then put on pillars. But even there the vibration was so great that the mantles broke more rapidly than in other parts of the city. It was a question, therefore, whether in that particular street they would not be obliged to revert to the old flat-flame burners. As to the other streets, they were as well lighted to-day as they had ever been; but in comparison some were very much better lighted, and the new mantles looked very large. The new lighting of London Road had surprised a great number of the representatives of the citizens; and the citizens themselves had been much astonished. London Road was now the best lighted street, not only in the city, but in the kingdom. They were giving a much better light at no increased cost; but he would remind them of the immense outlay on the lighting of the City. It was something like £12,000 a year more now than it was ten years ago. The normal increase of the cost was no less than £1000 a year. The Committee believed that light was life, light was morality, and that it was a great benefit to everyone; and they would give as much as they could as soon as they could. Mr. Hesketh reminded the Council of the powers given to the Electricity Committee to experiment in street lighting. He urged that the fixing of gas-lamps on the tramway trolley poles should not be carried out until they had further information from experiments in electric lighting that had been allowed to the Committee. No doubt there had been improvements in gas; but they were of recent date, as when the original permission was given for experiments in the electric lighting of some thoroughfares, the incandescent light was not invented. Electricity was making great improvements; and the Electricity Committee thought that, in view of the large amount of capital outlay on electricity, the Council should be chary in giving this order to the Gas Committee. He moved that the recommendation to affix the gas-lanterns on the trolley poles be deferred for the time being, by being referred back for consideration. He thought the Electricity Committee should have an opportunity of placing before the Council certain facts and figures, to show what could be done in the way of electric lighting. The amendment was seconded by Dr. Dreyfus. Mr. Wilson said that, by the

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adoption of the suggested plan, they would be able to do without thousands of gas-lamps and pillars, and make considerably more room on the footpaths. The tram-poles were in the best position for public lighting. The Corporation were only following the example of London and other cities; and it was a step in the right direction. Mr. Hesketh had not said one word about the cost of street lighting by electricity as compared with incandescent gas. Reference had been made to the old arc lights; but their experience of them in Albert Square was not satisfactory. They had had experiments enough in the Electricity Committee, and they did not want any more. Alderman Gibson, in reply, reminded the Council that the Gas Committee had just passed a resolution arranging for a conference with the Electricity Committee on the subject of street lighting. He had told the Chairman of the Electricity Committee that they were rowing in the same boat, and he was just as anxious for the success of the Electricity Committee as he was for the success of the Gas Committee. The amendment was lost, and the minutes of the Committee were adopted.

On the proceedings of the Electricity Committee coming up for consideration, the Chairman (Mr. Howarth) said that it was under no ordinary circumstances that he had to speak on behalf of the Committee; and he assured the Council that he felt his position very acutely. On personal and painful grounds, a colleague who was in the chair had resigned his position as a member of the Council. The position of the Committee at present was not an enviable one; and it must be difficult for some time to come. After referring to the informal meeting of the Committee held with reference to Dr. Bishop, and to the resolution unanimously passed by the Committee exonerating him, the Chairman said he thought, after further consideration, the Committee still felt that that was a wise resolution. They were fully alive to their responsibilities, and had appointed a Special Sub-Committee to go into the question of the whole administration of the department. This was a very large question, involving a great deal of work; but it was very necessary work. The Committee, however, were determined to devise a scheme which would put the department at the Town Hall, as well as at the works, on a strong and healthy footing. They were erecting very large works, in which a great amount of money was involved; and there were many large contracts still unfulfilled. But the Committee had reason to hope that, with the indulgence of the Council in giving them the necessary time to carry out those works, and by wise legislation and efficient administration, they would justify the confidence of the Council. Mr. Johnston, in the course of a long speech, referred to the large part deputations had played in the work of the Electricity Committee. Alluding to the circumstances under which Dr. Bishop had resigned his seat on the Council, Mr. Johnston said he understood that the clerk who had admitted making out the account for expenses without any instructions from Dr. Bishop had afterwards changed his mind and made a different statement. He then read the informal resolution passed by the Committee referred to by Mr. Howarth, and contended that those who signed it were guilty of a grave dereliction of duty. The Committee should have at once proceeded to investigate the whole affair. He moved, as an amendment, that, instead of a Special Sub-Committee being appointed by the Committee, the Council should proceed to the appointment of a Special Committee to investigate the affairs of the Electricity Department. The amendment was seconded, and led to a long discussion, in the course of which Alderman Richards, who took the chair at the informal meeting, said the Committee thought Dr. Bishop was paying the penalty by resigning his position as a member of the Council. He had refunded the overcharge, and the Committee decided it was a case in which they could afford to take a generous view. Ultimately, Mr. Johnston's amendment was defeated by a large majority, and the minutes of the Committee were confirmed.

SOUTHPORT CORPORATION GAS SUPPLY.

The Gas Committee of the Southport Corporation will reduce the illuminating power of the gas from 20 to 16 candles on the 25th inst.; the charge per 1000 cubic feet being fixed at 2s. 8d. for all purposes—the only exception being that of consumers of gas for cooking and heating, who came under the preferential rate before January, 1901. In the case of these, the charge for gas for cooking will continue to be 2s. 6d. Comparatively little change requires to be made in the plant in order to furnish gas of the lower candle power, as the question is mainly one of enrichment. In normal years, there is a net profit of about £8000 on the year's working. This year coal has cost about £1000 less than last, and higher prices are being received for residuals. In the past year's report of the Gas Committee, the gas consumed for illuminating purposes and that used for manufacturing, cooking, &c., was given together in one statement. Taking the previous year's figures as a guide, it is shown that the total consumption for ordinary purposes was about 377 million cubic feet. Of this, about 110 millions are accounted for as consumed in stoves, gas-engines, &c. At 4d. less per 1000 cubic feet for lighting gas used, this shows a loss of £4400 on the private consumers' account. The reduction of 9d. per 1000 cubic feet for public lighting will also tend to a diminished revenue. The Southport streets are lighted at cost price, and only Ainsdale and Birkdale need, therefore, be considered; and on about 4 million cubic feet the loss will be less than £150. No change will be made in the discount system; and on the accounts of consumers who have their gas on the prepayment system the loss will be about £240. There will thus be apparently, on this basis, a diminished revenue of about £5000. But the consumption of gas is on the increase; and cheaper gas will lead to still more being used. The loss mentioned will probably be greatly reduced by the saving on enrichers, and the cannel and oil accounts will be considerably reduced.

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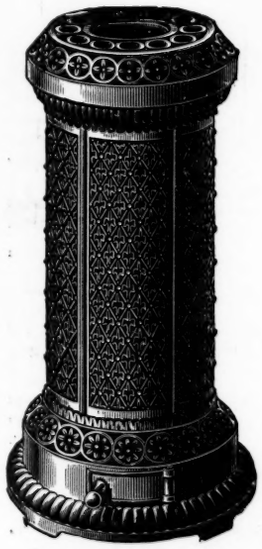

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AMALGAMATION IN THE TUBE TRADE.

Projected Union of Messrs. Lloyd and Lloyd and Messrs. A. & J. Stewart and Menzies.

It may be remembered that some weeks ago a rumour was in circulation to the effect that an amalgamation was imminent between the firms of Messrs. Lloyd and Lloyd, Limited, of Birmingham, and Messrs. A. & J. Stewart and Menzies, Limited, of Glasgow. It was stated at the time that there were no grounds for the rumour, but that in the event of any arrangement being come to for a union of the two undertakings, the shareholders would be duly informed thereof. We learn from the Birmingham papers that circulars in regard to the matter were sent out on Tuesday. The Directors of Messrs. Lloyd and Lloyd express the opinion that the proposed amalgamation is in the best interests of the Company, and they cordially recommend it to the shareholders for acceptance, believing that it will enhance the value of both the preference and the ordinary shares. Moreover, it will put an end to the keen competition hitherto existing between the two Companies. The Directors of Messrs. A. & J. Stewart and Menzies state that the arrangements may be described as an amalgamation, but, as a matter of convenience, they assume the form of a purchase by the Company. They point out that Messrs. Lloyd and Lloyd are the best known and largest tube makers in England, and that their goods have a world-wide reputation. The subject has for some time past had the careful consideration of the Directors, and they feel satisfied the amalgamation will be advantageous to shareholders.

The following particulars show the financial positions of the two Companies: Messrs. Lloyd and Lloyd were registered in May, 1898, to acquire the business of iron tube manufacturers. All the preference shares, £252,000 of the ordinary, and £121,000 of the debenture stock have been issued and paid up; and all the ordinary shares, £84,150 of the preference, and £68,500 of the debenture stocks were issued to the vendors and their friends. The preference dividend has been paid; but particulars as to ordinary dividends are not published, nor are reports issued. Messrs. A. & J. Stewart and Menzies first consisted of four amalgamated firms in or near Glasgow, which, early in 1898, combined with Messrs. James Menzies and Co. All the capital has been issued and paid up. There are borrowing powers for £250,000, which have been exercised to the extent of £200,000 by the issue of 3½ per cent. debentures. To June 30, 1890, 10 per cent. per annum was paid on the ordinary shares; and for the succeeding years to 1900, the dividends were 15, 9, 7½, 6, 3, 7, and 10 per cent, respectively—the last figure standing unaltered for three years. The reserve fund amounts to £209,000.

It is stated that the amalgamation is to be effected by the issue of cumulative preference and ordinary shares, and debentures or debenture stock, by the Glasgow Company to Messrs. Lloyd and Lloyd, against the transfer of the undertaking and assets of that Company, on terms agreed upon between the two Boards, subject to confirmation by the shareholders in general meeting. There will be some adjustments in cash. Messrs. Lloyd and Lloyd will nominate four Directors to seats on the Board of Messrs. A. & J. Stewart and Menzies. The name of this Company will be changed to Stewarts and Lloyds, Limited, and Messrs. Lloyd and Lloyd will go into voluntary liquidation and be dissolved. This procedure will ensure the amalgamation with the least possible interference with the management of the businesses. When it takes effect (on Jan. 1, 1903), the output of the amalgamated concerns will, it is believed, be about 50 per cent. of the total output of iron and steel tubes in Great Britain; and the Company will be the largest producers of tubes in the world, with the exception of the United States Steel Corporation. The number of employees will be something like 8000, and a staff of 450 clerks will be employed in the different offices and warehouses at home and abroad.

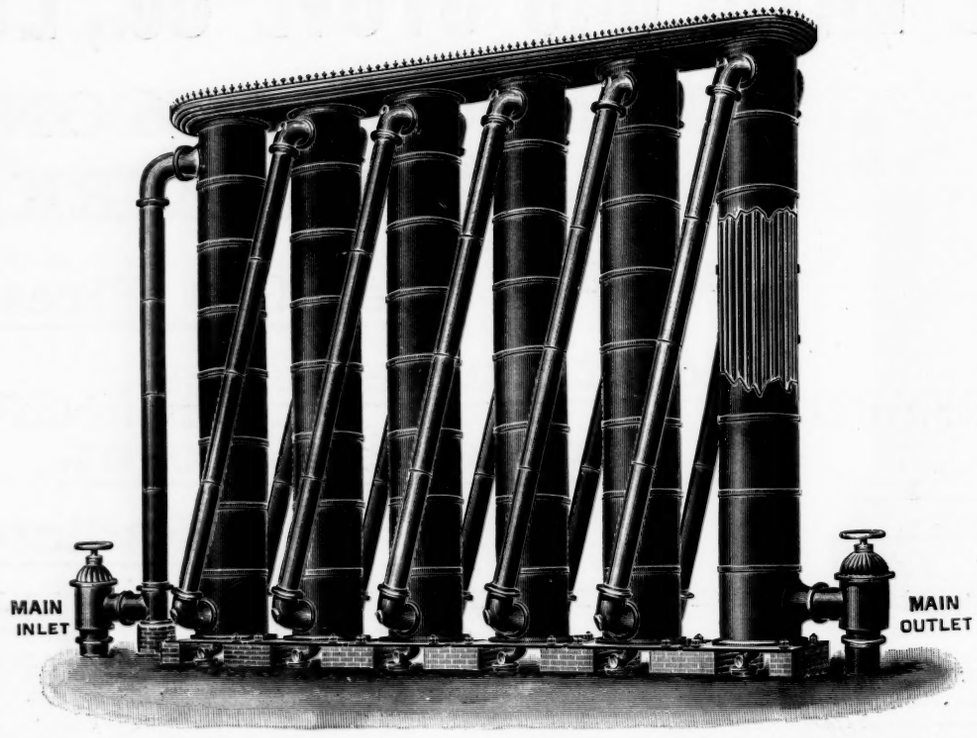
PENNY-IN-THE-SLOT METERS AND STOVES.

Extended Use in Newcastle-on-Tyne.

In opening, on Monday evening last week, a series of cookery demonstrations specially arranged by the Newcastle-upon-Tyne and Gateshead Gas Company to show the working of penny-in-the-slot cooking-stoves, which are now largely used in the Company's district, the Chairman (Sir W. H. Stephenson, who is also Mayor of Newcastle) gave an interesting sketch of the history of gas lighting, and showed how, notwithstanding competition from other illuminants, the gas business continued to prosper. He said that, so far as his own Company were concerned, they had never taken a backward step, but, on the other hand, had advanced steadily and constantly year by year. Their purpose that night was to try to familiarize their friends the consumers, or the non-consumers as the case might be, with the latest developments of using gas, especially in regard to cooking and heating. There could be no manner of doubt that to a large extent the happiness of the family life was contributed to by the regular and the proper feeding of its members; and this had been rendered easy by the introduction of the gas cooking-stove. Careful comparative tests had proved beyond doubt that a joint cooked in a gas-oven always weighed heavier (to the extent of 15 to 20 per cent.) than a similar joint cooked in a coal-oven; and, moreover, gas-stoves, while at command at all hours, did not involve any labour in lighting, and scarcely any in cleaning. He need not say anything more as to the advantages of gas cooking generally. This must be admitted from the manner in which the use of cooking-stoves had developed. But what he wanted to bring before them was the new departure taken by gas companies in placing within the reach of the artisan the combination consisting of the cooker, gas-fittings for

CONDENSERS.

WATER COOLING.



ATMOSPHERIC.

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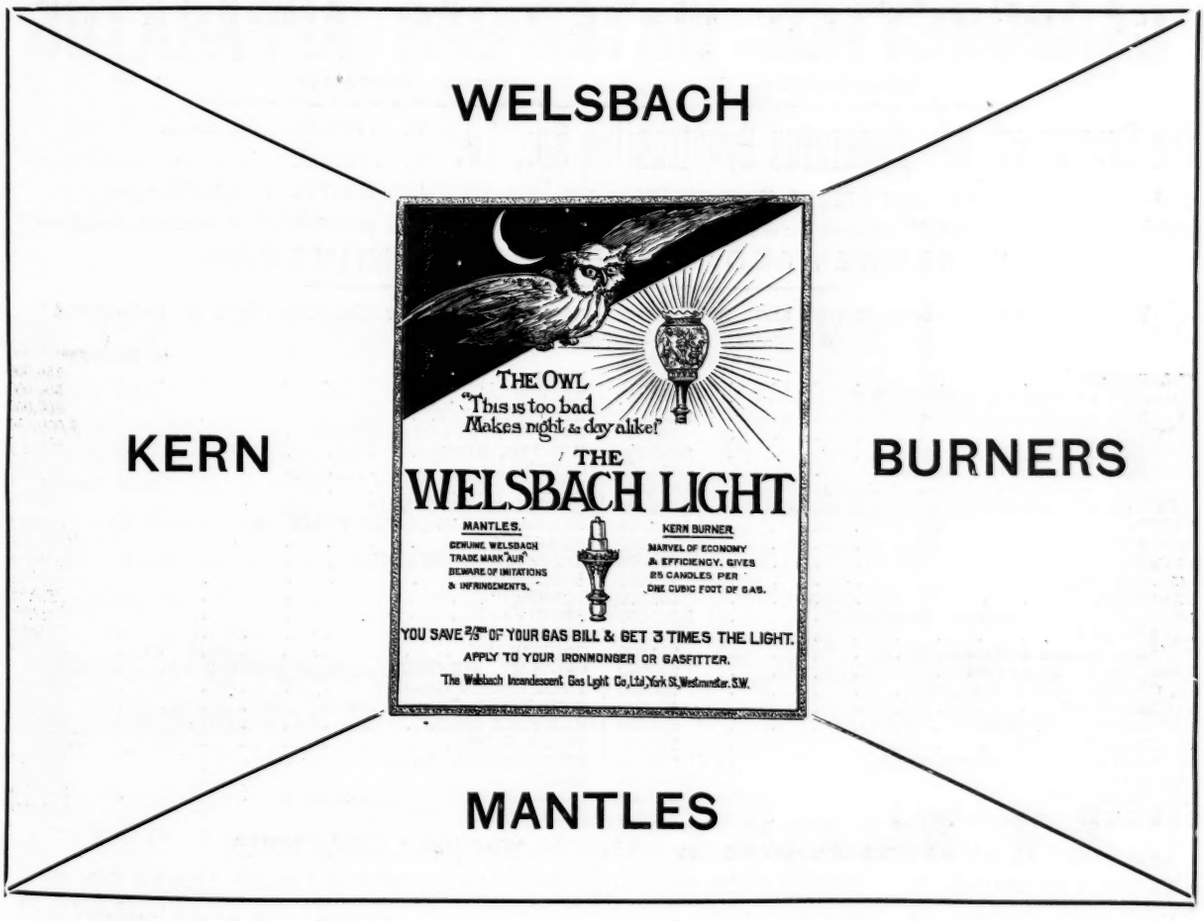
lighting, and the penny-in-the-slot meter, thereby introducing an admirable system of prepayment for gas. They could regulate their consumption more easily; there was no gas bill coming in three or four months after the gas had been consumed, and thus no temptation to be extravagant. It was most surprising what a penny would do. They talked about the nimble ninepence, but nowadays the nimbleness of the penny was surely more striking. For a penny, 29 cubic feet of gas was given; and this quantity would cook a dinner consisting of joint, vegetables, and pudding. The popularity of these penny-in the slot meters and cookers was proved by the fact that, although the Company only started the system in Newcastle and Gateshead rather less than two years ago, they had now 12,700 installations, and were at present fixing them in at the rate of 200 a week. They were rather costly, and the Company urged consumers to take care of the articles—in fact, it was to the consumer's interest to keep them clean. Mrs. Smith, the lady selected as demonstrator, then gave her first lecture, others being given every evening till Friday.

COUNCIL AND WATER COMPANY.

Forcible Removal of Pipes from the Ground.

A somewhat extraordinary condition of affairs was revealed at the last meeting of the Eton Rural District Council, when the Surveyor of Highways (Mr. A. Gladwell) reported that the Rickmansworth Water Company had, in an unauthorized manner, and without giving notice or warning to the district road authorities, and in a parish over which they had no jurisdiction, proceeded to lay about 70 yards of water-mains. He warned the foreman in charge that he was committing a trespass; and, finding this caution was disregarded, he (the Surveyor), on the following day, proceeded to take up the pipes by dragging them out of the ground with a traction engine, lent to him by Colonel Trench. Colonel Trench said the Council were aware of the negotiations being carried on between the Rickmansworth Water Company and various people in the county with regard to their carrying mains through Gerrard's Cross. However, a stop was put to the proceedings by the County Council; the digest of the objection being that the county authority insisted—and he thought rightly—that the Company should give an assurance that they would not take more water out of the county than they brought into it. There was a strong feeling on the question of the springs; and it was considered that water companies must not go through the open country roads unless they would agree not to take out water. The upshot of it was that the Rickmansworth Company demurred. The Secretary and the Solicitor said they had no intention to take any water away. On the 14th of last month, he received a telegram asking whether he was still opposed to the Company taking their mains through Gerrard's Cross to other places in the neighbourhood. He replied that, far from being opposed, he was anxious that they should lay their mains on the reasonable conditions imposed by the County Council. Subsequently, he wrote to the Secretary of the Company asking whether they were prepared to carry out the work as required. He received a polite reply, saying that they would endeavour to supply Gerrard's Cross, if they could do so by means of the district roads. He wrote to them rather strongly, and pointed out that on the previous day they had taken the law into their own hands and carried out an unauthorized operation in laying pipes along the district road through the parish of Langley, over which they had no jurisdiction, and notwithstanding that the Surveyor had warned them not to do so. The Surveyor, in the exercise of his duty, had removed them. Since then, he had received a letter from Sir Henry E. Knight, the Chairman of the Company, saying that he would be very pleased to meet him, and pointing out that the difficulties of supplying water to Gerrard's Cross seemed so very slight that a little discussion should clear the way. This meeting might or might not come off. He also felt it his duty as a member of the Council to point out that it was quite impracticable to supply Gerrard's Cross with water by laying the pipes through the district roads, because the District Council would not allow them to do as they proposed. The County Council were most anxious to prevent the Rickmansworth Water Company taking Bucks water without equally supplying them. He concluded by moving a resolution endorsing the action taken in the matter by the Surveyor; and this was unanimously agreed to. Some further discussion on the matter having taken place, Colonel Trench said he should be very sorry to prevent Fulmer and Hedgerley getting water; but he thought if such a thing would help the Council they should apply for an injunction to prevent the Company opening the roads without permission. He moved that a claim for damages be made; and that unless an assurance be given by the Company that they would not open the District Council's roads again without permission, an injunction be applied for. This was seconded and carried.

General Gas Company of France.—At the recent annual meeting of this Company, the accounts presented showed that the profits produced by the works amounted to 968,988 frs.; those arising from shares in other undertakings, interest, &c., to 2,070,450 frs. These two sums, together with 446,240 frs. brought forward, made a total of 3,485,678 frs. (£139,427), compared with 3,995,951 frs. and 3,585,621 frs. in the two immediately preceding years. The lower figures last year are partly accounted for by the fact that the balance brought forward was about 400,000 frs. less than that for 1900-1901. A sum of 2,170,046 frs. was available for distribution, and of this 1,300,000 frs. were paid to the shareholders, 86,190 frs. were placed to the statutory reserve, 82,890 frs. went to the Directors and the holders of founders' shares, 250,000 frs. to the provident fund, and 450,966 frs. were carried forward. After these additions to the reserve and provident funds, they were brought up, with the balance brought forward, to 6,918,290 frs. The dividend declared was 32 frs. 50c. per share.



NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The success of the meeting of the North British Association of Gas Managers which was held in Perth at the end of July last was largely due to local arrangements. Among the foremost in the work of preparation and superintendence was Bailie Watson, the Convener of the Gas Committee of the Corporation; and, in recognition of his services, the Committee of the Association held a special meeting in Perth last Saturday, at which they presented him with the photographs taken at Scone Palace and Drummond Castle as mementos of the occasion. The presentation was made by Mr. J. Wilson, of the Tradeston Gas-Works, Glasgow, who was the President of the meeting. Bailie Watson suitably acknowledged the gift.

It is with pleasure that I record that, on the occasion of his leaving Alloa for Dundee, Mr. A. Yuill was last night the recipient of several valuable presents from the Corporation and community of Alloa, as tokens of the esteem in which he is held in the town. The Corporation and subscribers met in the Municipal Buildings, under the presidency of Provost Arrol, who made the presentations. These consisted of a silver salver and tea service and an Estey organ. Provost Arrol said that Mr. Yuill was well known to them, having been in Alloa for about 17 years; and in him, during all that time, the Town Council and the ratepayers had had a trusted, tried, and true servant. When he came to Alloa, Mr. Yuill found their gas-works in second-class condition; but to-day they were among the foremost in Scotland, both as to cheapness and quality of gas. Mr. Yuill's experience in Alloa would stand him in good stead in Dundee; and they congratulated him on this higher appointment and this wider field for his capabilities. He was an able and a clever man, and they could not hope to keep him in such a small place like this burgh; but in Dundee, where he would have a larger field and a greater outlet for his capabilities, they wished him every success. Mr. Yuill, in returning thanks, said that in doing what he had done in Alloa, he felt that he had simply done his duty in the interests of the people; and in doing so he was conscious of the fact that he had reaped his reward in the kindness and the friendship that had always been bestowed upon him in Alloa. He referred to his career in Alloa, which dated back to the year 1886, and remarked that the make of gas now was almost four times more than it was when he came. He also referred to the improvements that had been effected through the enterprise of the Gas Commissioners in introducing gas-cookers, penny-in-the-slot meters, and other appliances, all which had not only increased the consumption of gas, but tended to cheapen the price of it. A gentleman had said to him that at one time Dundee supplied the cheapest gas in Scotland; and he (Mr. Yuill) would endeavour to place Dundee in the same position as it formerly occupied. He was exceedingly grateful for their kindness in presenting him with such valuable gifts. He would ever look upon them with much pleasure, and they would always remind Mrs. Yuill and himself of the many kind friends they had left behind in Alloa.

In their peculiar process of working out the problem presented to them by the outcry with reference to alleged increases in gas bills, the Corporation of Perth, on Monday last, received a report from the Gas Treasurer, to the effect that of the consumers who had received a circular asking them to state their reasons for declining to pay, about one-half had sent in replies. These were remitted to the Convener of the Gas Committee, the Gas Treasurer, and the Gas Manager, to consider and report upon. With regard to the others, the Treasurer was instructed to issue a final circular stating that unless replies were sent in within seven days it would be assumed that there was to be no further objection. The issue of this final circular is simply a trifling with the subject. If the Gas Committee are satisfied that the amounts are due, they have only one course open to them—to enforce payment; and if they think that relief can be, or ought to be, given otherwise, they can give it for the future. But as to the past, it is not in the power of the Committee to do anything in the way of compromise.

The incident which I referred to as in process of development at Kirkcaldy, with reference to an action by the Kirkcaldy Gaslight Company, Limited, to recover payment of an account for gas consumed, has ended rightly. The account was against the occupier of the premises, as being the consumer, and at the last calling, Sheriff-Substitute Gillespie ordered the action to be intimated to the landlord of the place. The defence was the very ingenious one that, the leakage being among the rafters of the house, the gas escaped and was not consumed; and it was stated further that the occupier complained to the landlord about the want of light, and that therefore, if there was any fault, it was on the part of the landlord. This, of course, was a very specious plea, and would have implied the introduction into the Sale of Goods Act of conditions which are not to be found therein. It looked, when the Sheriff called in the landlord, as if he were disposed to give weight to the defender's plea; but on Wednesday, after hearing evidence on the subject, Sheriff-Substitute Gillespie held the tenant to be liable, and gave decree against him, with expenses. The law was thus vindicated; but, in doing it, the Sheriff went out of his way, because he put into his judgment a reservation to the tenant to recover the sum he has lost from the landlord. In his opinion, stated orally, the occupier must fight out the question with the landlord. Of course, it is open to the tenant to do so, and no reservation of his right is required for the purpose; but it is almost a pre-judging of the case to give the reservation.

There was a little breeze at the meeting of the Montrose Town Council last Monday night on the subject of the lighting of the town. The Clerk read a petition from shopkeepers in Castle Street, complaining that the bad lighting of the street militated considerably against their business. The petitioners invited inspection, and expressed the opinion that a 500-candle power lamp between the present lamps would be sufficient to light the street. The suggestion caused some laughter. The petition was referred to the Lighting Committee. Then the new

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.
BLACKBURN	1,250,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD.	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA.	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract Remodelled)	2,000,000
BELLEVILLE.	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000

	Cubic Feet Daily
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON.)	250,000
TOKIO, JAPAN.	1,000,000
PERNAMBUCO (Brazil)	125,000
MALTON	150,000
DULUTH, MINN. (Second Contract)	300,000
BROCKVILLE (ONT.)	250,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 Cub. Ft. SMETHWICK, 500,000 Cub. Ft. LEICESTER (2nd Cont.), 1,000,000 Cub. Ft.
GRAVESEND, 300,000 C. Ft. NEWPORT, MON. (2nd Cont.), 250,000 C. Ft. TORONTO (3rd Cont.), 750,000 C. Ft.

Convener of the Committee (Mr. D. S. Masterton), in a long speech, denounced the lighting of the town as miserable. He said he had found that the incandescent electric lamps in a large number of the streets were practically worn out, and "merely flickered like penny candles." He had also found that the arc lamps were in such a condition that the Council ought to call upon the Electric Light Company to carry out their agreement by lighting the town in a proper manner. He went on to condemn the lamps as "castaways;" but he was called to order by the Provost. Whereupon a little "scene" ensued—Mr. Masterton declaring that he was not going to be blamed for the bad lighting, and that in calling attention to it he was only doing his duty. Eventually the question of the lighting of Castle Street was remitted to the Committee.

On Tuesday, a workman in the gas-works of the Alyth Gas Company was overcome by the fumes of gas while employed in the changing of a purifier. The man was brought back to consciousness by a doctor. As to the plant, it was found that a large leak of gas was taking place between the purifier and the station meter. The gas was turned off the town till this was repaired.

A most deliberate suicide is reported from Edinburgh this week. A clerk named Arnold Aldis on Sunday night asked his landlady for some paste. During the night, the landlord noticed a smell of gas, and got up and searched for it; but failed to discover anything wrong. In the morning, the lodger did not appear; and when his bedroom door was tried, it was found that he had pasted it up with brown paper, and left the gas turned full on. He was dead when discovered. The young man was a student; and his extraordinary conduct is attributed to over-study having unhinged his mind.

Notwithstanding the manifest failure of the scheme for the supply of water to Arbroath from the pumped service, there is a section of the community who still look to it as their best source. At a meeting of the Finance Committee of the Town Council on Thursday, a petition, signed by 250 ratepayers, was presented, asking that a public meeting be called for the purpose of considering the water question, with a view to a plebiscite being taken before proceeding with a gravitation scheme, and in order to discover whether the Nolt Loan supply (the pumped supply) might not yet be further tested. The Committee acceded to the request, and a meeting of the ratepayers has been convened for the 18th inst., "in order to gather the feeling of the town regarding the whole question of the water supply previous to the Magistrates and Council taking further steps."

The Körting two cycle gas engine, for the manufacture of which Messrs. Mather and Platt, Limited, of Manchester, are licensees, was awarded two gold medals at the Düsseldorf Exhibition—one going to Gebrüder Klein, for a 700 brake horse power Körting engine made by them; and the other to the Siegener Maschinenbau Actien Gesellschaft, for a similar engine of 500 brake horse power.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 6.

Sulphate of Ammonia.

There has been good demand throughout the week at hardening prices, and the closing quotations are £11 12s. 6d. per ton f.o.b. Hull, and £11 15s. per ton f.o.b. Liverpool and Leith. Speculators who have December contracts to cover have proceeded without delay with the operation. Consumers abroad also, finding the low offers for forward delivery recently current withdrawn, have turned their attention to the spot market; but so far their ideas have not kept pace with the advance. For delivery over the spring months, considerable sales have been made at £11 17s. 6d. per ton f.o.b., and at the close £12 is the asking price.

Nitrate of Soda.

This is steady on spot at 8s. 10½d. and 9s. per cwt., for ordinary and refined qualities respectively. In the forward position, the market is firm, but without quotable alteration in value.

LONDON, *Dec.* 6.

Tar Products.

The position remains about the same, with the exception that there is a decidedly improved demand for benzol. A large business has been done in 90 per cent. at 10d. f.o.b. for export, January-June next; and a considerable quantity has also been placed for home consumption at about the equivalent price. Pitch remains very firm; and there is a strong demand for home consumption, but, as regards export, there is scarcely such a strong inquiry for early delivery. Several inquiries are still being made for delivery over next year, and in some instances dealers are open to contract for January-June, 1904. Anthracene remains in precisely the same position, but there is, if anything, rather more inquiry for the higher percentages, delivery over next year. In Toluol further business has been done at 8d., December shipment; while the same price is reported to have been declined over 1903. Crude carbolic is easier. There are now sellers at 1s. 8d. for December; but there is no inquiry for January-June. Fortunately, however, makers are not so anxious to sell over this period, and consequently prices may improve a little later. There is an absence of business in crystals; the only demand being for 39-40's in special packages. The market for creosote continues fairly steady, especially in London, where the demand is good. There is, however, rather more offering in the Provinces; and the demand is not quite so brisk for early delivery. Solvent is very dull, but several contracts are reported in special qualities for home consumption.

Average values during the week: Tar, 21s. to 26s. Pitch, London, 56s. 6d. to 58s.; east coast, 54s. to 55s.; west coast, 52s. 6d. to 53s. 6d. Benzol, 90 per cent., 9¼d. to 10d.; 50-90 per cent., 8¼d. Toluol, 7⅞d. to 8d. Crude naphtha, 3¼d.; solvent naphtha, 8⅜d. to 9¼d.; heavy naphtha, 9d. to 10d. Creosote, London, 1⅜d.; North, 1⅛d. to 1⅛d. Heavy oils, 2d. to 2⅛d. Carbolic acid, 60 per cent., 1s. 8d.

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

PREVENTS NAPHTHALENE DEPOSITS.

OVER **100** MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

Among the Companies and Towns supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Southport, Alloa, Broughty Ferry, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Seven Years.

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas

For Prices and full Particulars, apply to

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

Naphthalene, 35s. to 55s.; salts, 23s. 6d. to 26s. 6d. Anthracene, "A," 1½d. to 1⅝d.; "B," 1d. nominal.

Sulphate of Ammonia.

The market is decidedly firm; and there is a strong demand for forward delivery. The Gaslight and Coke Company will not at present quote for December, although their nominal price may be taken as £11 15s. For January-April, they have declined £11 17s. 6d., and are quoting £12, but are not anxious sellers over this period. Another large gas company declined £11 13s. 9d. for December, but would accept £11 15s. for some quantity, shipment this month. In Hull, business has been done at £11 12s. 6d. for December, but the same price was declined for January-June. As regards Leith, £11 13s. 9d. has been paid, and business is also reported at £11 15s., while sales for forward delivery have been made at £12 January-June. The position of the market appears very strong, especially for forward delivery, for which the demand is still very considerable.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The improvement reported last week is being more than maintained, not only as regards round coals, but an increasing inquiry has been coming forward for engine classes of fuel. The keener weather of the last few days necessarily stimulates the demand for house-fire qualities; and with the near approach of Christmas, a brisk business is now anticipated for the next two or three weeks. Collieries are mostly moving away all they are raising; and prices are firm at recent full quotations—averaging 15s. up to 16s. per ton at the pit for best qualities, 13s. 6d. to 14s. 6d. for medium sorts, and 10s. 6d. to 11s. 6d. for common house fire coals. The lower descriptions of round coal continue in only indifferent request. At the pit, prices remain steady at from 8s. 3d. up to 8s. 9d. per ton for good qualities of steam and forge coals. One or two fairly large contracts for engine fuel are upon the market; and generally there has been a good deal of inquiry during the past week, with the result that the market has steadied. Though there are still some low priced surplus lots on the market, chiefly from outside districts, undercutting is less noticeable. In the Lancashire district, prices are being held to at about 4s. 3d. to 4s. 9d. per ton for common, 5s. 6d. to 6s. for medium, and 6s. 6d. up to 7s. for the best qualities of slack. In the shipping trade, moderate business is passing through in steam coals, with prices ranging from 10s. to 10s. 3d. per ton for common, to 10s. 6d. to 10s. 9d. for better sorts, delivered at the ports. For slack, large inquiries are still reported on the market for shipment to America, chiefly for gas making purposes The slack, however, has to be delivered at the ports on the Mersey in size and price so as to escape the export duty; and 6s. per ton represents the average figure.

Northern Coal Trade.

The coal trade is easier; due, in part, to the influences of weather delaying the arrivals and sailings of the collier fleet. This has been most felt in the steam coal trade, which is often quiet at this season of the year. Best Northumbrian steam coals are quoted from 11s. 3d. to 11s. 6d. per ton f.o.b. Second-class steams are 10s. to 10s. 3d., and steam smalls are easier at from 5s. 3d. to 5s. 9d. The collieries have worked fairly well, though with an occasional idle day through lack of steamer arrivals. For gas coals, the demand is now at its fullest; and the production is large. The heavy contracts take up the bulk of the output; and thus there is little for sale. The quotations for occasional cargoes are from 9s. 3d. to 10s. per ton f.o.b., according to quality. It is rumoured that the contracts have been closed for the gas coal for one of the Spanish cities at a price that leaves about 8s. 9d. per ton f.o.b.; but this is dependent on the freight. The contracts are believed to be for delivery over the next two years. Gas coke is in fuller supply, with rather irregular quotations of price.

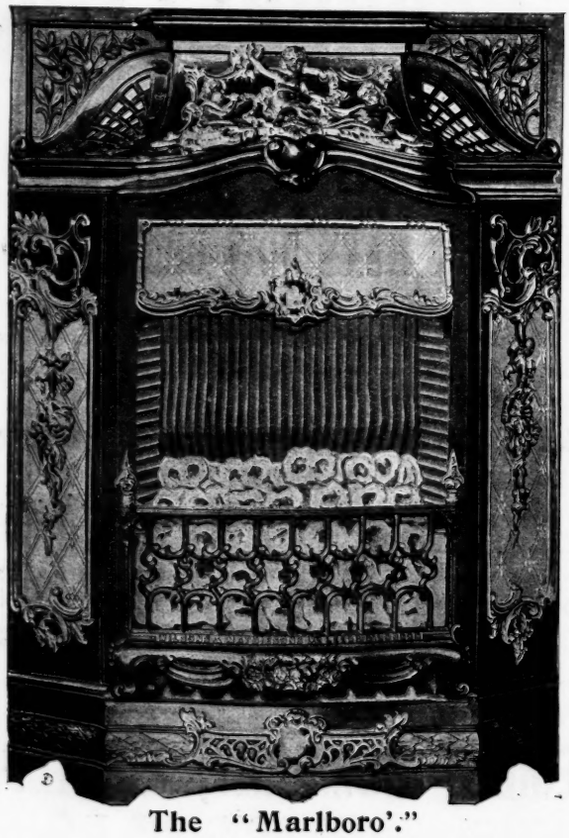
Scotch Coal Trade.

The demand for all classes is strong, for immediate delivery. Forward contracting is more difficult; and there is little prospect of change. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 11s. 3d., and splint 11s. to 11s. 3d. The shipments for the week amounted to 255,532 tons—an increase of 10,129 tons upon the preceding week, and of 68,631 tons upon the corresponding week of last year. For the year to date, the total shipments have been 10,199,352 tons—an increase of 1,067,916 tons upon the same period of last year.

Inspection of Water-Fittings in Philadelphia.—The re-inspection of all water fittings which has lately taken place in the city of Philadelphia is summarized as follows in the report of Mr. W. C. Haddock, Director of the Department of Public Works, for 1901. The total number of inspections amounted to 248,226, and 40,418 properties were discovered having appliances for which no water-rents were being paid. The total number of delinquent appliances revealed by the inspection was 70,660. The water-rent chargeable in respect of these fittings amounted to $146,057. The cost of the inspection was $26,448; showing a net revenue of $119,609 to the city.

Aberavon Gas-Works Question.—A special meeting of the Aberavon Town Council was held last week to consider the means to be adopted in order that an efficient and satisfactory supply of gas should be furnished by the existing works. The Gas Manager (Mr. A. Bond) explained at considerable length the capabilities of the works, and said he estimated that it would cost about £5000 to make them efficient for another seven or ten years; but he certainly did not recommend any extensions on the present site. After much discussion, it was resolved to await the report of the Electrical Engineer on the subject of electric lighting before deciding upon a definite course of action.

The Artistic Series of the



The "Marlboro'."

WILSON Gas-Fires.

	No. 2.	No. 3. 22½in. by 31½ in. high, 8in. deep.
Size 22 in. wide by 30½ in. high by 8 in. deep; width of fire opening 12 in.; with black mounts and black or ivory tiles	£4 10 0	.. £5 5 0
Ditto.—Electro-brass, copper or copper-bronze mounts, blue or ivory tiles	6 0 0	.. 6 15 0
Ditto.—Solid burnished brass mounts and blue or ivory tiles	7 5 0	.. 8 0 0
Tiles ornamented with gold	0 7 6	.. 0 7 6
Fitted with Patent "Duplex" Burner	0 7 6	.. 0 7 6

WILSONS & MATHIESONS, LTD.,
Carlton Works,
ARMLEY, LEEDS; and
76, Queen Street,
CHEAPSIDE, LONDON, E.C.

WRITE FOR FULL LIST.

Failure of Gas at Langport.—The inhabitants of Langport were much inconvenienced last Tuesday evening by the total failure of the gas supply. It appears that the new Company, who had laid down fresh plant, &c., had also erected a number of retorts; these being placed on a concrete bed, owing to the flooding of the works at certain periods of the year. The recent rains have raised the waters of the River Parrett to overflowing, and the country round is in consequence submerged. On Tuesday, the concrete bed gave way under the pressure of water, and the fires were speedily extinguished. The gasholder being at the time empty, the streets and houses of the town were promptly plunged into darkness.

Power-Gas Corporation, Limited.—The second ordinary general meeting of this Company was held last Thursday—the Right Hon. Sir Henry Fowler, M.P., in the chair. In moving the adoption of the report and accounts, noticed last week, the Chairman said the Directors could only give the general results of the business during the past twelve months; but already a large number of orders had been received, several of which were in hand, and they would keep the works going for some time. It was most gratifying to the Directors to know that some of the firms which they had already supplied were contemplating an extension of their installations, and were in negotiation for supplies of further plant. As to the future business, or its character, he could only say, so far as they had gone, they were quite satisfied with the progress the Company had made. They were fully confident that, with their works complete, they would be able to undertake all the business offered, such as the equipment of electric stations, gas-engines, dynamos, and other accessories. The report was unanimously adopted.

German Incandescent Gas Share Company, Limited.—The annual meeting of this Company was held in London last Tuesday week. Mr. R. T. Bayliss, who presided, expressed regret that the results of the past year's working compared so unfavourably with those of its predecessors, and that, owing to the fall in the dividend paid by the German Company from 28 to 7 per cent., the Directors were able to recommend a dividend on the shares of only ⅜ per cent., as compared with 3 per cent. last year. A complete statement of the causes which had led to the serious diminution in the profits of the German Company was set forth in the report submitted by the Directors of that concern. That Company's shares now stood at 2550 marks, compared with 3100 marks at the time of the last annual meeting. A requisition was lodged on the previous day for convening an extraordinary general meeting for the purpose of considering the position of the Company, and the desirability of winding it up, and distributing its holding of the German Company's shares *pro rata* among the shareholders. The report was adopted. A long discussion followed on the proposal to wind up the Company, and it was eventually decided that a meeting in accordance with the requisition, should be called to consider such resolutions as might be thought most advisable in the interests of all the shareholders.

The Water-Gas Plant at Carlisle.—Messrs. Corbet Woodall and Son have reported to the Gas Committee of the Carlisle Corporation the completion of the carburetted water-gas plant, the total cost of which has been £12,863. They state that the work has been satisfactorily carried out.

Incandescent Gas-Lights for Ripponden Church.—St. Bartholomew's Church, Ripponden, is to be lighted with incandescent burners, and the work will be completed as soon as possible. It is intended to put in three-light pendants with Welsbach high-power burners between the pillars, the chancel is to have brackets, and the sacrarium will be lit with standards.

Suffocation by Coal Gas.—An old Cardiff tradesman, Matthew Thomas, a retired painter and paperhanger, was found asphyxiated on Saturday, the 29th ult. His daughter, finding he had not risen at his accustomed time, entered his bedroom, and discovered her father dead on the bed. As she opened the door she was met by what she described as a "gust of gas" from the room, which almost took her breath away. It was discovered that the gas-jet was full on.

Southwark and Vauxhall Water Company.—The report of the Directors of this Company for the six months ending the 30th of September sets forth that the number of new domestic supplies taken into charge during the half year was 845, estimated to produce an increased annual rental of £1954, and, in addition, the income derived from supplies by meter and other sources shows a satisfactory increase on the corresponding period of past years. The Directors recommend that a half-year's dividend at the rate of 5 per cent. per annum on the preference stock and of 7 per cent. per annum on the ordinary stock and "D" shares should be declared.

Private Bills for Next Session.—There have been deposited at the Private Bill Office of the House of Commons 46 plans in connection with railways, 38 in relation to tramways, 60 miscellaneous, and 150 Provisional Orders, including tramways and electric lighting—total, 294. These figures may be compared with those of this time last year, which were: Railways, 48; tramways, 23; miscellaneous, 73; Provisional Orders, including tramways and electric lighting, 174—total, 318. It is a remarkable fact that, though the totals under the different headings vary, the aggregate number of Bills (as distinct from Provisional Orders) is exactly the same this year as last.

Grand Junction Water-Works Company.—The report of the Directors of this Company for the half year to the 30th of September shows that, after providing for all liabilities and for the dividends recommended, the amount of undivided profit carried forward will be £34,805, compared with £32,967 at the commencement of the half year. The increase in the number of supplies during the six months was 1428, making a total of 71,372. The Directors recommend a dividend at the rate of 8 per cent. per annum on the £50 "A" shares and £25 "B" shares, of 7½ per cent. per annum on the £25 "C" shares, and of 7 per cent. per annum on the £50 "D" shares.

A Burning Question.

DOES IT PAY TO SUPPLY CONSUMERS WITH

AN ECONOMICAL HEATING STOVE?

CLARK'S

PATENT

"SYPHON"

STOVES.

Give invariable satisfaction both in Efficiency and Economy.

CONSUMERS APPRECIATE AN ECONOMICAL HEATING STOVE.

S. CLARK & Co., Patentees and Makers, Compton Works, Canonbury Road, HIGHBURY; and "Syphon" Works, Park Street, Islington, LONDON, N.

The London County Council and the Water Bill.—The London County Council have prepared a statement in opposition to the London Water Bill. After referring, among other things, to the fact that the Bill perpetuates the system by which the poorer classes in London are charged at a higher rate than the richer classes, and that certain local authorities in Kent, by a Bill for next session, give notice of breaking up the proposed Board, the Council suggest the abandonment of the whole Bill for the following reasons: The proposed authority is unsatisfactory; and while the Bill confers no benefit upon the water consumers, and perpetuates the evil of the existing inequality of water charges, it involves grave risk to the ratepayers, the useless disturbance of existing local authorities, and the unnecessary creation of a new local body. The Council recognize that Lord Llandaff's Commission and the decisions of the Joint Committee have tended to clear the ground. At the same time, they urge that the previous attempts of the Council to negotiate with the Companies have been rendered futile, because Parliament has refused to allow them to bring their own Bill before a Committee. They suggest that if the Companies appoint a negotiator, the Council will be recommended to do the same, in order that some agreement as to purchase might be made between the Council and the Companies. They add that "any such agreement could only be provisional and subject to the sanction of Parliament, and would leave open the question of the authority to own and manage the undertakings to be dealt with by a Bill introduced in a future session."

The Power-Gas Corporation have secured the contract from the Buenos Ayres Western Railway for a Mond gas installation to be used in the railway works at Buenos Ayres.

The effect of shortening the working day to comply with the eight-hour law will, it is estimated, increase the cost of the work remaining to be done under the contract for the new Croton dam of the New York Water-Works by about $305,000; the contract having been based upon a ten-hour day.

Messrs. Hayward-Tyler and Co., of Whitecross Street, E.C., are issuing a very neatly got-up catalogue (List M) of their electrically-driven and other treble-barrel pumps. The illustrations are beautifully printed; and particulars of the various types of pumps and their capacities are given below them. Tables of standard sizes, with code-words for ordering, will be found at the end of the book.

At a recent chrysanthemum show held in St. George's Market, Belfast, great praise was bestowed upon the lighting, which was done by the James Keith and Blackman Company, Limited; the arrangements being carried out by their Engineer (Mr. H. G. Harness). The installation consisted of 42 burners, giving an aggregate illuminating power of 14,000 candles, consuming 420 cubic feet of gas per hour; thus costing for lighting the large market about 1s per hour. The burners were supplied with gas from the city mains; the pressure being increased by means of a Keith compressor using 60 gallons of water per hour. This was the only cost incurred in compressing the gas. By this system of lighting, a 1000 candle power light costs, in Belfast, less than 1d. per hour.

The annual dinner to the employees of the Davis Gas-Stove Company, Limited, was held on Saturday, the 29th ult., at the Great Eastern Hotel, Liverpool Street, E.C., when about 300 sat down to dine under the presidency of Mr. H. J. Davis, with Mr. C. W. Davis in the vice-chair. After the usual loyal toasts, Mr. Porter proposed "Success to the Firm," which was duly responded to by the President. The Vice President then gave "The Employees," to which Mr. H. C. Turner, the Works Manager at Camberwell, responded. An interesting feature of the proceedings was a presentation to Mr. Harold N. Davis, son of the President, and Manager of the Falkirk and Luton works of the Company, of which he is a Director, in connection with his approaching marriage. The gift, which came from the employees and staff of the London section of the stove-works, consisted of three vases for table decoration and two *entrée* dishes of tasteful design; and it was presented by Mr. Turner, and suitably acknowledged by the recipient, who thanked the men for their kindly thought of him.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

SITUATIONS VACANT.

CARBONIZER TO TAKE CHARGE OF WORKS. G. L., London Bridge Station.
DRAUGHTSMAN. Gibbons Bros., Dudley.
DRAUGHTSMAN. No. 3951.
DRAUGHTSMAN. No. 3957.
DRAUGHTSMAN. No. 3958.
FITTERS. Rotherham Gas Department.
MAIN AND SERVICE LAYER. Redditch Gas-Works.
MAIN AND SERVICE LAYER. Ripon Gas Department.
SHOW-ROOM ATTENDANT AND CLERK. Ilford Gas Company.
SLOT METER AND INCANDESCENT MANTLE ATTENDANT, &c. No. 3950.
SUPERINTENDENT FOR EXTENSION OF WORKS. Sevenoaks Water Company.

SITUATIONS WANTED.

ASSISTANT TO ENGINEER OR MANAGER. No. 3959.
TRAVELLER IN GAS STOVE TRADE. Howland, Faversham.

AGENT WANTED BY GERMAN MANUFACTURER. No. 3939.

CONTRACTOR FOR GAS TUBES AND FITTINGS WANTED. F. G., Liége, Belgium.

GAS ESCAPE INDICATOR FOR SALE (Patent). Medd, Twickenham.

MORTGAGE BONDS.

SHREWSBURY GASLIGHT COMPANY.

PLANT, &c. (Second-Hand), FOR SALE.

COMPLETE GAS-WORKS PLANT. Edinburgh and Leith Gas Department.
GASHOLDER. Wright, London.
PURIFIERS, SCRUBBER-WASHERS, GASHOLDERS, &c. Firth Blakeley, Dewsbury.
SCRUBBER, TAR EXTRACTOR, EXHAUSTERS, BOILERS, HYDRAULIC MAIN, VALVES, &c., &c., Ashford Gas Department. Tenders by Dec. 12.
STATION METERS (2). Oxford Gas-Works.

PLANT, &c. (Second-Hand) WANTED.

ENGINE AND EXHAUSTER. Ruabon Gas-Works.
TANK AND GASHOLDER. Wright, London.

PUPIL REQUIRED. No. 3950.

TENDERS FOR

ENGINE AND EXHAUSTER HOUSE.

TEIGNMOUTH GAS DEPARTMENT. Tenders by Jan. 6.

EXHAUSTERS, &c.

TEIGNMOUTH GAS DEPARTMENT. Tenders by Jan. 6.

GASHOLDER.

HINCKLEY GAS DEPARTMENT. Tenders by Dec. 20.

GASHOLDER TANK (Steel).

HINCKLEY GAS DEPARTMENT. Tenders by Dec. 20.

MAINS AND CONNECTIONS.

TEIGNMOUTH GAS DEPARTMENT. Tenders by Jan. 6.

RETORT BENCH AND STRUCTURAL ALTERATIONS.

TEIGNMOUTH GAS DEPARTMENT. Tenders by Jan. 6.

RETORT CARBON.

WOOLWICH ARSENAL. Tenders by Dec. 22.

SCRUBBER-WASHER (Holmes) AND LIVESEY WASHER.

TEIGNMOUTH GAS DEPARTMENT. Tenders by Jan. 6.

TAR.

BRIDGEWATER TRUSTEES. Tenders by Dec. 22.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON HOUSE,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications RE OXIDE to the COMPANY as above.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

DUTCH OXIDE OF IRON.

ERSTE Hollandsche Yzererts Maaty
(First Dutch Bog Ore Company, Ltd.), ROTTERDAM.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.
London Managers—
E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

COAL GAS TAR wanted.
Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding-Scale Basis.
State Quantity to offer for Prompt and Forward Delivery.
The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.
FIRE Cement, Paint, Mains, Tubes,
STREET LANTERNS, GLASS, TOOLS, &c.
BALE & CHURCH,
5, CROOKED LANE, CANNON STREET,
LONDON, E.C.

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance. If credit is taken, the charge is 25s. a year.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

TO GAS AND WATER OFFICIALS.

HIGH CLASS CYCLES at lowest Prices guaranteed and sent on APPROVAL for Cash or GRADUAL PAYMENTS. Catalogue and Testimonials from Gas Managers post free.
MELROSE CYCLE COMPANY, COVENTRY.

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

BY the adoption of Cripps's Bye-Pass VALVES inside your Purifiers, you can relieve the Back-Pressure in the Lower Tiers when the Purifying Material gets hard. They are extremely useful and economical.
Sole Makers: C. & W. WALKER, LIMITED, Midland Iron-Works, Donnington, near Newport, SHROPSHIRE.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

IT is worth your while to buy direct. THE RELIANCE LUBRICATING OIL COMPANY 19 and 20, Water Lane, Great Tower Street, London, E.C., handle all kinds of Lubricating Oils, for Engines, Cylinders, Dynamos, Spindles, &c., Burning Oils, Solar Distillates, Carburetting Oils, and Spirits for Gas Making; Motor Oils, Fuel Oils. Animal, Fish, and Vegetable Oils, &c., for all purposes. Write for our "Trade Mark" Inkstand, sent free to customers. Non-customers, 2s. 6d. each. RELIANCE LUBRICATING OIL COMPANY, London, Glasgow, Newcastle-on-Tyne, &c. Established 1858. Telegraphic Address: "Subastral," London; A.B.C. Code used. Telephone No.: Avenue 5891.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PATENTS AND TRADE MARKS PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
19, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "LUMINOSITY."

SULPHATE OF AMMONIA SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

MR. S. J. HOWLAND, late with Messrs. John Wright and Eagle Range, Limited, desires position as TRAVELLER. Good References.
Address 55, Newton Road, FAVERSHAM.

AGENT Wanted, by German Works, for the sale in the United Kingdom of WATER-METERS, HYDRAULIC BLOWERS, WATER-PRESSURE INDICATORS, and other Appliances. A well-introduced Civil Engineer preferred.
Apply, by letter, to No. 3939, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SITUATION wanted by a Young Scotchman (Age 23) as ASSISTANT to Gas Engineer or Manager. At present employed as Assistant in medium-sized Works. 8½ years' experience. Good Draughtsman. Holds First-class Certificate in Gas Manufacture; also on Advanced Building Construction. Good knowledge of Chemistry.
Address No. 3959, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MAIN and Service Layer (good) wanted. Permanency to suitable Man.
State Age, Wages required, and enclosing *copies* of Testimonials, to ALBERT E. LAYTON, Manager, Gas-Works, REDDITCH.

DRAUGHTSMAN wanted. Modern Gas Plant and knowledge of Producer Gas Apparatus.
Address No. 3958, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Main and Service Layer for Two or Three Months. Applicants must state Salary required.
Apply to W. T. LANCASTER, Engineer and Manager, Gas Department, RIPON.

THE COUNTY BOROUGH OF ROTHERHAM.
(GAS DEPARTMENT.)

WANTED, First-class Fitters. Must be well up in Iron and Compo. work.
Apply, stating Wages, to the undersigned,
FRANK A. WINSTANLEY,
Engineer and Manager.

WANTED, for a Single-Handed Gas-Works thirty miles from London, a good CARBONIZER, who could take charge generally. Wages 22s. and comfortable cottage on the works, with Coal and Gas. Must have previously had similar employment.
Apply, by letter, with *copies* only of testimonials, to G.L., Smith and Son's Bookstall, S.E.C.R., LONDON BRIDGE.

WANTED, for a few Months, at a Provincial Gas-Works, a DRAUGHTSMAN experienced in Gasholder work, and competent to take out quantities, prepare Estimates, &c.
Apply, stating Age, Experience, and Salary required, to No. 3957, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an experienced Draughts-man, capable of taking entire charge of Drawing Office. Must have thorough knowledge of Coal and Coke Elevating and Conveying Plant of all descriptions. Must also be efficient in Retort-House and Gas-Works Plant in general. Commencing Salary £250 per annum.
Apply to GIBBONS BROS., LTD., DUDLEY.

WANTED, a thorough Draughtsman, for a Gas Company near London, capable of Taking out Quantities, Making Estimates, and well acquainted with all kinds of modern apparatus for the Manufacture and Purification of Coal and Oil Gas.
Arply, by letter, stating Age and Salary required, and also give an account of previous training, No. 3951, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PUPIL.

THE Engineer (M.Inst.C.E.) of a large Provincial Gas Undertaking has a vacancy for a Premium PUPIL. Large extensions now in progress, which will afford exceptional opportunities of gaining a good knowledge of the construction of a modern Works.
Address No. 3960, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ILFORD GAS COMPANY.

SHOW-ROOM ATTENDANT AND CLERK.

WANTED, a Man not under 20, used to the business, to act as above, and to receive payment of Accounts.
Apply, stating Age, Experience, Salary required, and when able to commence Duties, to the SECRETARY, Ilford Gas Company, Cranbrook Road, ILFORD.

WANTED, by a Gas Company in the North of England (population 150,000), a smart, active, intelligent Man, who has had experience in Prepayment Meter Installation, Mantle Maintenance, and canvassing for Consumers.
Applications, with not more than three recent Testimonials, stating Age, Experience, and Salary required, to be sent (by post) before Dec. 14, to No. 3950, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SEVENOAKS WATER-WORKS COMPANY.

WANTED, by the above Company, a reliable Man, not over Forty Years of age, to superintend the work of Extension to an outlying District, which will include Pumping-Station, Reservoir, and Mains, at a total cost of about £8000.
Apply, by letter only, in first instance, giving full Particulars as to experience in Water-Works practice, with Reference, and state if accustomed to good work.
FRED HUNTER,
Manager.
Water-Works Office, Oak Lane,
Sevenoaks, Nov. 27, 1902.

FIRST-CLASS Belgian Firm require Contractor for best GAS TUBES and FITTINGS.
Address "F. G.," Annonce Metallurgique and Charbourrière, Liége, BELGIUM.

WANTED, Good Second-hand Engine and EXHAUSTER, 5000 cubic feet per hour.
Particulars and Price to GEO. E. WOODFORD, RUABON.

TO BE SOLD—Gasholder, Two Lifts, with Five Columns, 43,000 feet capacity, which can be increased to 49,000 feet if preferred.
Write J. WRIGHT, 181, QUEEN VICTORIA STREET, E.C.

FOR SALE—A New Patent Gas Escape INDICATOR, to avoid Gas Explosions or Suffocation.
Apply to G. MEDD, 80, Queen's Road, TWICKENHAM.

FOR SALE—Early next Year, Two STATION METERS, each for 30,000 feet per hour, by A. Wright and Co. Cylindrical cases, in good order, now working, with 12-inch Valves and Connections. Suitable for Water Gas.
Can be seen at the GAS-WORKS, OXFORD, on application to the ENGINEER.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

HINCKLEY URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE above Council are prepared to receive TENDERS for a GASHOLDER and STEEL TANK.
Drawings may be seen and Specification, with Form of Tender obtained, from the Engineer and Manager, Mr. Fred Lee, on payment of One Guinea, which will be returned upon receipt of a *bonâ-fide* Tender.
The Council do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, endorsed "Gasholder," to be sent to me on or before Saturday, Dec. 20, 1902.
A. S. ATKINS,
Clerk.
Hinckley, Dec. 5, 1902.

WAR DEPARTMENT CONTRACTS.

TENDERS are required for the Sale by the War Department of about Fifty Tons of RETORT CARBON at the Gas Factory, Royal Arsenal, where it can be seen.
The Carbon will be loaded free into Trucks on the Royal Arsenal Railway Sidings, or in Barges alongside the Royal Arsenal Wharves.
Forms of Tender will be issued on application to the Superintendent, Building Works, Royal Arsenal, Woolwich, not later than Monday, the 22nd day of December, 1902.
M. T. SALE, C.M.G., Colonel (Ret.),
Superintendent, Building Works.
Royal Arsenal, Woolwich,
Dec 4, 1902.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.

DISUSED GAS PLANT.

THE Commissioners have for Disposal the whole of their GAS-WORKS PLANT formerly comprising the Leith Gas-Works, consisting of RETORT and FURNACE FITTINGS, HYDRAULIC MAINS, BUCKSTAYS, FLOOR PLATES, ANNULAR and TUBULAR CONDENSERS, DONKIN'S STEAM-ENGINES and EXHAUSTERS, ROTARY WASHER-SCRUBBERS, PURIFIERS and COVERS of various sizes, &c., &c., &c.
Permits to View, and Quotations for all or sundry parts of the Plant, to be addressed to Mr. W. R. HERRING, Gas-Works, New Street, EDINBURGH.

THE Bridgewater Trustees are prepared to receive TENDERS for the TAR produced at their Coke-Works for a period of Six or Twelve Months from the 1st of January next, delivered into Contractor's Tanks at the Trustees' Brackley Siding on the Little Hulton Mineral Branch of the L. & N. W. Railway, or their Wharton Hall Siding on the Pendleton and Hindley Branch of the L. & Y. Railway.

The estimated quantity for the Twelve Months is 2500 Tons; and Tenders, endorsed "Tender for Tar," addressed to the Bridgewater Trustees, 4, Chapel Walks, Manchester, should be delivered on or before the 22nd of December.

SHREWSBURY GASLIGHT COMPANY.

MORTGAGE BONDS.

THE Directors are prepared to accept sums of £100, or multiples thereof, on MORTGAGE BOND, specially secured by Act of Parliament upon the Company's Property and Revenues, at £3 10s. per cent. per annum, repayable at the end of one year, or afterwards subject to Six Months' Notice on either side. Other periods may be arranged to suit lenders.

Interest payable half yearly, at Lady-day and Michaelmas.

Apply to the SECRETARY,
Gas Offices,
Shrewsbury.

Nov. 1, 1902.

URBAN DISTRICT COUNCIL OF TEIGNMOUTH.

TENDERS are invited for the following EXTENSIONS and ALTERATIONS at the Gas-Works:—

1.—A new RETORT-BENCH of Shallow Regenerators.
2.—STRUCTURAL ALTERATIONS to RETORT-HOUSE.
3.—DUPLICATION of EXHAUSTING PLANT.
4.—A new ENGINE and EXHAUSTER-HOUSE.
5.—A new HOLMES SCRUBBER-WASHER, and LIVESEY WASHER.
6.—All new MAINS and CONNECTIONS required in the re-arrangement of Plant.

The Plans may be seen, and a copy of Specification, General Conditions, and Form of Tender obtained, on application to Mr. J. Alex. Gray, Gas Engineer, Teignmouth.

A Payment of One Guinea will be required for a copy of the Specification, which will be returned on receipt of a *bonâ-fide* Tender.

Sealed Tenders, endorsed "Gas-Works' Extensions," to be delivered at the Clerk's Office, Town Hall, Teignmouth, at any time previous to Ten a.m. of Tuesday, the 6th day of January, 1903.

A. PERCIVAL DELL,
Clerk to the Council.

Town Hall, Teignmouth,
Nov. 25, 1902.

ASHFORD (KENT) URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Lighting Committee of the above Council have FOR DISPOSAL the under-mentioned GAS PLANT recently put out of use in consequence of enlargements.

One SCRUBBER, 30 feet high by 5 feet diameter, with Tippler House, 10-inch Connections, Three 10-inch VALVES, LADDER, GRIDS, &c.
One TAR EXTRACTOR (Washer), 5 feet square, with overflow, 10-inch Connections, Three 10-inch VALVES, &c.
One 10-inch CENTRE VALVE and CONNECTIONS for four Purifiers.

All the above are of Messrs. C. & W. Walker's make (1887), and in good condition.

Two EXHAUSTERS (Rotary), 15,000 cubic feet per hour—one being Donkin's make, two Blades, and one Waller's make, three Blades, with four 6-inch Valves, one 6-inch Bye-Pass Valve and Connections, 10-inch and 6-inch.
Two Egg-end BOILERS, 9 ft. by 3 ft., with Fittings complete.
One dished-end BOILER, 9 ft. by 4 ft.
One 6-inch Four-Way HYDRAULIC VALVE.
One TRAVELLING LIFT for 12 feet Purifier Lids.
One " 8 " "
Four pieces of STEEL "HYDRAULIC MAIN," D, 16 in. by 16 in., 36 feet total length.
Twenty-eight feet of TURNED SHAFTING, 2⅞ inches and 2¼ inches.
Twelve PULLEY-WHEELS (various sizes), two pair COUPLINGS.
Nine PLUMMER BLOCKS and CARRIAGES, two 3-inch FORCE PUMPS, NAVY PUMP, and sundry CONNECTIONS, PIPES, SCRAP, CAST, and WROUGHT IRON.

Tenders for all or sundry part of the above will be received by the Committee on or until Friday, Dec. 12, 1902, and must be addressed J. Morton, Gas-Works, Ashford, Kent, endorsed "Tenders for Materials."

By order,
G. HARPER,
Chairman.

Nov. 25, 1902.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of the Company, so far as they relate to DEBENTURE STOCK, WILL BE CLOSED at Ten o'clock forenoon on Friday, the 12th of December, for the Half Year ending the 31st of December, 1902, and will be RE-OPENED on Friday, the 19th of December.

The Interest for the Half Year will be payable on the 1st day of January next to the Proprietors registered on the closing of the Books,

By order of the Board,
JAMES RANDALL,
Secretary.

Chief Offices:
639, High Road, Tottenham,
Dec. 5, 1902.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS, in respect both to the FOUR-AND-A-HALF PER CENT. and the THREE PER CENT. DEBENTURE STOCKS, WILL BE CLOSED from the 11th to the 31st of December inst., both days inclusive, and RE-OPENED on the 1st of January, 1903, on which day the Interest Warrants on these Stocks will be payable.

By order,
I. A. CROOKENDEN,
Secretary.

St. Helen's Place, Bishopsgate Street, E.C.
Dec. 2, 1902.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

BOOKS AND LEAFLETS

TO BE OBTAINED OF

WALTER KING,

11, BOLT COURT, FLEET STREET, E.C.

HANDBOOK FOR GAS ENGINEERS AND MANAGERS.—By THOMAS NEWBIGGING, M Inst.C.E. (New Edition in course of Preparation).

INTERNATIONAL ENGINEERING CONGRESS (GLASGOW, 1901))—THE PROCEEDINGS OF THE GAS SECTION. Edited by J. W. HELPS, M.Inst.C.E. *Price* 5s.

BIRMINGHAM CORPORATION (Windsor Street) GAS-WORKS.—By CHARLES HUNT, M.Inst.C.E. *Price* 21s.

CONSTRUCTION OF GAS-WORKS.—By S. HUGHES. *Price* 5s. 6d.

GAS LIGHTING.—By CHARLES HUNT. *Price* 18s.

GAS MANUFACTURE FOR STUDENTS.—By J. HORNBY. *Price* 5s.

GAS ENGINEERS' POCKET BOOK. — By H. O'CONNOR. *Price* 10s. 6d.

MODERN METHODS OF SAVING LABOUR IN GAS-WORKS.—By C. E. BRACKENBURY. *Price* 3s. 6d.

MODERN APPLIANCES IN GAS MANUFACTURE — By FLETCHER W. STEVENSON. *Price* 5s.

ZURICH NEW GAS-WORKS.—By A. WEISS, Engineer of the Works. *Price* 2s. 6d.

THE GUIDE-FRAMING OF GASHOLDERS, and other Papers —By F. SOUTHWELL CRIPPS, Assoc. M Inst.C.E. *Price* 6s.

GASHOLDER AND TANK AT THE SUTTON GAS-WORKS (one million cubic feet capacity).—By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E. *Price* 3s. 6d.

GASHOLDERS WITH OR WITHOUT GUIDE-FRAMING.—A Discussion between E. LLOYD PEASE and F. SOUTHWELL CRIPPS. *Price* 1s.

THE VALUATION OF GAS, ELECTRICITY, AND WATER-WORKS FOR ASSESSMENT PURPOSES.—Second Edition. By THOMAS NEWBIGGING, M.Inst.C.E., and WILLIAM NEWBIGGING, Assoc.M.Inst.C.E. *Price* 5s.

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